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Animal Welfare Issues Compendium

A Collection of 14 Discussion Papers

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Cooperative State Research, Education and Extension Service

Plant and Animal Production, Protection and Processing

Animal Welfare Issues Compendium

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There are many confusing nuances within the concepts of animal welfare, animal well-being, animal rights, and related terms. County and state Cooperative Extension personnel often are asked to comment or provide advice to clientele relative to a particular event or piece of information touching on animal welfare. To address the information requirements of county and state Extension personnel, we have enlisted the assistance of a number of authors and co-authors, as well as numerous reviewers to produce the 14 discussion papers in this compendium.

Authors were chosen for their expertise in commodity areas, and knowledge of animal welfare issues. We requested individuals from many points within the ideological spectrum of animal welfare/rights to review the papers.

Because of the controversial nature of this topic, and to ensure an adequate review of these papers, a double review was conducted. The authors retained the right to make final corrections and decisions regarding the content of their articles. Persons on the review committee were only responsible for review and editing the document. Their views were seriously considered but may or may not be reflected in the final document. The authors are responsible for the final product.

The papers are not intended to be all inclusive or the final word on these issues. Readers are encouraged to use the references provided with most papers as further resources, and to reach their own conclusion on these emotion laden and often difficult to understand issues. We hope these papers are of assistance in this process.

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ANIMAL WELFARE ISSUES

A CRITICAL ANALYSIS

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INTRODUCTION

Animals have contributed to human welfare since prehistoric times. The domestication of plants and animals for food, fiber, and other purposes was an integral part of the development of agriculture ([Council for Agricultural Science and Technology \[CAST\] 1981](#)).

During the years in which humans and animals have interacted since animal domestication, changes have been made in both the animals and their husbandry. The act of male castration, possibly the first surgery, was practiced first on humans without anesthesia ([CAST, 1981](#)). Later, large animal species were castrated as part of the domestication process. Without the widespread use of this incidental surgery early in the animal's life, control of cattle for the development of settled agriculture would have been delayed. Use of oxen (castrated male bovine) as the first nonhuman power source made possible the production of enough grain to release some of the people from the responsibility of food production ([CAST, 1981](#)). This, in turn, permitted the development of civilization with decreasing agricultural orientation.

Today, people use animals to ride; to provide power; to serve as guards; to assist with specific types of jobs; and to become subjects for research. Many people also find satisfaction in companionship from pets, as well as from the use of dogs for hunting, horses for riding, and various animals as participants in competitive events. However, the primary importance of domestic animals for people in the United States is as a source of milk, eggs, meat, wool, hair, leather, pharmaceuticals, and other byproducts.

DISCUSSION

Efficiency

Mench and Van Tienhoven ([1986](#)) report that remarkable increases in the efficiency of poultry and livestock production have occurred during the last half-century. In the United States, for example, the number of eggs a hen lays annually has doubled during this period, while the amount of feed consumed for each egg produced has decreased by 50 percent. Because of these improvements in egg production and feed efficiency, the cost of eggs to the consumer since 1925 has risen by only 40 percent, which is considerably less than the cost increases of most other consumer goods. Similar trends are apparent in beef, pork, poultry meat, and dairy production ([CAST 1980](#)).

Many factors have contributed to these improvements. Major roles in increasing efficiency and improving animal health

have been played by sophisticated techniques of artificial selection; advances in the detection, treatment, and prevention of disease; mechanization of farm labor; and the development of nutritionally balanced animal feeds. In addition, the increasing use of light- and temperature-controlled housing provides protection from extremes of weather and predation and permits the control of the photoperiod necessary to stimulate growth and reproduction ([Mench and Van Tienhoven 1986](#)).

Food and Production Guidelines

Farmers and consumers have benefitted greatly from the modernization of animal agriculture. However, since the publication of "Animal Machines -- The New Factory Farming Industry," by Ruth Harrison ([1964](#)), public concern about the treatment of farm animals has risen steadily. Harrison found most of her examples in the farming and veterinary press. With a foreword by Rachel Carson, of "Silent Spring" fame, Harrison's book was especially critical of (1) the use and misuse of hormones, antibiotics, and additives to animal feeds and (2) the care and handling of farm animals, especially hens kept in cages and veal calves housed in crates.

This book landed like a bomb in England. Within a year the Brambell Report ([1965](#)) to Parliament, which inquired into farm animal welfare, was published. The investigation was followed by the release of various Codes of Recommendations for the Welfare of Livestock in the U.K. ([1971](#)) including chickens, turkeys, pigs, cattle, sheep, rabbits, and ducks. The codes are advisory; failure to observe them is not in itself an offense. They have legal standing, however, and a person cannot claim ignorance of them as a defense.

The passage of legislation regulating animal production in England and the European Economic Community is complex and analyses of it can be found elsewhere ([Ewbank, 1988](#)). Similar legislation has been proposed by animal welfare groups in the United States.

A growing number of U.S. agricultural commodity groups have guidelines and codes of practice on animal welfare in place. Guides that have been produced voluntarily by industry provide good examples of the ethical placement of priority on animal care and handling, as well as the self-policing nature of industry (See Supplemental Reading -- General Guidelines). A useful starting point for U.S. guidelines on farm animals is the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching ([Consortium, 1988](#)). Chapters 5 through 11 include separate guidelines for husbandry for beef cattle, dairy cattle, horses, poultry, sheep and goats, swine, and veal calves. The guide was prepared by animal scientists, veterinarians, industry representatives, and agricultural engineers.

Certain commercial husbandry procedures that may cause some temporary discomfort or pain are done to sustain the long-term welfare of animals. These special agricultural practices are widely accepted as standard operating procedures if they are:

- warranted within the context of agricultural production,
- performed by or under the direct supervision of capable, trained, and experienced personnel, and
- performed with precautions taken to reduce pain, stress, and infection.

Husbandry procedures and production methods should be revised as research at agricultural research stations and elsewhere suggests improvements. Research on improved methods and procedures is encouraged ([Consortium 1988](#)).

Animal Suffering

Cruelty is defined as having or showing indifference to, or pleasure in, another's pain or suffering. Producer-originated animal suffering has been categorized in three areas:

- **neglect**, e.g, failing to provide an animal with a vital requirement such as food, water, or shelter,
- **abuse**, e.g, striking or willfully harming an animal with a club or instrument of harm, and
- **deprivation**, e.g, limiting an animal's freedom or preventing an animal from associating with others of its kind ([Ewbank, 1980](#)).

Most humane societies can identify animal suffering and follow through with legal prosecution. There should be no place in any industry for those who mistreat animals.

Cases of deprivation are difficult to resolve, as they involve the denial of certain, perhaps less vital, needs of the animal's environment. In some cases, these needs have not been definitely established. The veal industry is an example. Earlier introduced as HR2859 and HR84, the Veal Calf Protection Act ([1989](#)) assumed that close quarters and lack of physical contact among veal calves caused behavioral and social deprivation. The counter-argument is that placing the animals in individual stalls helps prevent spread of disease. This issue and related ones concerning rigid diet, iron status, additives, and government regulation, as well as the need for further research, have been carefully stated. They remain unresolved ([Schwartz 1990](#)).

That farm animals can suffer and have "behavioral needs" was expressed in the Brambell Report ([1965](#)) from England. Since that time, many English and other European animal welfare advocates, administrators, and scientists have accepted "behavioral needs" as doctrine. In the United States, issues related to animal behavior, physiology, the external appearance of animals, ways of expressing emotion, learning processes, and "behavioral needs" are still being discussed. Research and interpretation concerning farm animal perception and cognition are needed ([Curtis and Stricklin 1991](#)).

A scientific assessment of animal welfare was compiled earlier by Fox ([1984](#)), who studied welfare determinants; cognitive ethology; animal sentience, sapience, and self-awareness; and animal consciousness, feeling, and suffering. Duncan and Petherick ([1991](#)) have distinguished between needs and desires, sensing or detecting, feeling and perceiving, memory and learning (expectation or anticipation), recall, and awareness. More recently, the idea has emerged that welfare is mainly ([Dawkins 1990](#)) or solely ([Duncan 1993](#); [Duncan and Petherick 1991](#)) dependent on what the animal feels. Stanley Curtis has stated that farm animal regulations are inevitable in the future only if producers fail to police themselves properly. Expressing concern about the impact of animal activists on legislation, Curtis says:

As activists push for farm animal regulations, it's vital that those regulations be based on research about how animals think and feel. I'm very concerned about letting naive people decide what's best for animals, because we all tend to anthropomorphize -- when we look at an animal, we imagine ourselves in the animal's place. But what the animal itself thinks and feels is more important than what we imagine. That's really the crux of the issue ([Martz, 1991](#)).

Narveson ([1986](#)) is critical of Regan's ([1983](#)) statement that animals have "concepts" and that "perception, memory, desire, belief, self-consciousness, intention, a sense of the future" are among the leading attributes of the mental life of normal mammalian animals aged one year or more.

In the animal welfare movement, there is concern over the consciousness of suffering ([Harrison 1964](#); [Singer 1975, 1990](#); [Mason and Singer 1980, 1990](#); [Dawkins 1980](#); [Fox 1980, 1984](#)). Animal welfare activists suppose that animals may be conscious of suffering if either the structure of their nervous systems or their reactions to stimuli resemble those of humans. The reactions of farm animals to stimuli of pain or fear, which we at once recognize as resembling our own, are of three kinds ([Baker 1948](#)):

- the struggle to escape,
- the contortion of parts of the body, especially the face,
- the production of sounds that are unusual in the ordinary course of life and are either loud and piercing or subjectively appear to us as mournful.

Barbara Orlans ([1993](#)) modified a chart by Katherine Morgan (1986) that provides [an overview of classification categories of animal-related organizations](#). These preliminary classifications use attitudes toward animals, from exploitation to liberation, to label various types of organizations. The Orlans model, which uses five categories, is included. The Morgan model lists six categories of organizations, including the additional "animal control" designation.

Welfare: Definitions and Explanations

The elusive nature of defining the concept of animal "welfare" has been summarized by Ewbank (1988) as follows:

Many attempts have been made to define the term welfare as applied to animals. Two recent and widely used definitions are: 'Welfare on a general level is a state of complete mental and physical health where the animal is in harmony with its environment' ([Hughes 1976](#)), and 'The welfare of an individual is its state as regards its attempts to cope with its environment' ([Broom 1986](#)).

Both definitions refer in a general way to the balance which exists between the animal and its surroundings. They are not immediately helpful at the practical level in determining whether an animal is in fact enjoying a correct balance. For practical purposes, there is merit in simply replacing the word 'welfare' by the terms 'health' and 'well-being', both of which have strong positive components. Health is more than the mere absence of disease and well-being is more than the absence of discomfort and distress. This positive approach is to be welcomed because it inherently encourages high standards and it also plays into the natural pride of the good stockman in having contented, thriving and productive animals.

In the past, farm animal welfare has been considered primarily in relation to maximization of productivity. Fox ([1984](#)) states that there are no clear-cut correlations between productivity and animal well-being. He claims, however, that neglecting the welfare side of farm animal science by making productivity the sole criterion of sound husbandry practices can be counterproductive. When greater attention is given to the animals' physiological, emotional, and behavioral well-being, he states, the animal will be healthier and more productive. Fox apologizes for not offering a "variety of easily adoptable, tried and true, humane and more profitable alternatives." Still, he says, "These will come when all of us who are involved begin to think less in terms of productivity, short-term costs, and other narrow self-interests, and more in terms of the animals, their well-being, our treatment of them and our moral humane obligations toward them, science and ethics notwithstanding."

In addition to productivity, criteria that should be considered in assessing welfare or well-being are animal behavior, health, musculoskeletal soundness (lameness), reproduction, immune status, and physiological endpoints ([Albright 1987](#) and [Zimbelman 1991](#)). It is vital both for the health and well-being of the animals involved and for the financial future of the farming industry that an increasing critical interest should be taken in the mixture of economic, scientific, ethical, aesthetic, and practical concepts that make up the complex subject of animal welfare, and that action should be taken on the new knowledge and ideas thus gained ([Ewbank 1988](#)).

Animal Welfare and Animal Rights

What is the distinction between animal welfare and animal rights? Animal welfare reflects people's concern for the humane treatment of animals and is regarded as more representative of the societal mainstream. It appears to have growing support from society at large. In contrast, proponents of animal rights hold that animals must not be exploited in any manner. In other words, the only interactions humans should have with animals are those that occur by happenstance or those that are initiated by an animal. Animal rights advocates believe that animals have basic rights -- many say, the same as people -- to be free from confinement, pain, suffering, use in experiments, and death for reason of consumption by other animals (including humans). Thus, animal rights advocates oppose the use of animals for food, for clothing, for entertainment, for medical research, for product testing, for seeing-eye dogs, and as pets. Currently, animal rights doctrine is essentially philosophical, anti-vivisectionist, vegetarian, pro-activist, moralistic, and urban-based ([Albright 1986](#)). The animal rights proponents believe that humans have evolved to a point where they can live without any animal products -- meat, milk, eggs, honey, leather, wool, fur, silk, byproducts, etc. These advocates offer a long list of concerns in support of the conclusion that neither medical researchers nor the cosmetic industry has the right to experiment on animals. They also conclude that the animal kingdom is exploited by hunters, zoos, circuses, rodeos, horse racing, horseback riding, the use of simians (small primates) to assist quadriplegics in wheelchairs, and by the keeping of animals as pets.

[Kim Bartlett](#), editor of "The Animal's Agenda," a magazine published by the Animal Rights Network, Inc. in 1991, states:

It is indeed true that there is a fundamental theoretical difference between animal 'rights' and animal

'welfare,' as commonly defined: the animal 'rights' advocate would argue that animals have certain inalienable moral rights which humans should not violate; the animal 'welfarist,' however, accepts the notion that humans have a right to use animals, as long as suffering is reduced or eliminated. In theory, the animal 'welfarist' would work exclusively for the *reform* of cruel or abusive situations to *alleviate* animal suffering, while the animal 'rights' activist would focus on the *abolition* of cruel or abusive situations to *eliminate* animal suffering."

Animal rights advocates often express concern for welfare problems, but the eventual or hidden animal rights agenda is that of a purist. In one example, the goal is not larger cages/pens but the elimination of cages/pens. The concept of not using animals for any reason at all eliminates choices or discussion. Thus, the debate over how best to promote animal welfare shifts to a debate on animal rights versus human rights ([Mathis 1991](#)).

The case for animal rights has yet to be fully argued as a test case in a court of law. Under English common law, animals are considered to be personal property, and the animals themselves have no rights. In a U.S. case, the court decided that a dog "is something else" -- not just a thing, but occupying a special place somewhere between a person and a piece of personal property. The court ruled that the plaintiff had suffered mental anguish and despondency due to the defendant's wrongful destruction of the remains of her dog for whom she had planned an elaborate funeral; she was awarded damages beyond the market value of the dog (Kay Corso, Plaintiff, vs. Crawford Dog and Cat Hospital, Inc. Defendant. 97 Misc. 2nd 530: 415 N.Y.S. and 2nd 182 Civil Court of the City of New York, Queens County, March 22, 1979).

The Pros and Cons of Animal Rights

Salt ([1892](#)) preceded Singer ([1975](#)) by many years with a discussion of the rights of animals and possible lines of reform. However, sensitivity to issues involving animal rights intensified into a movement in the mid-1970s. The modern movement gained momentum with the publication of "Animal Liberation" by philosopher-vegetarian Peter Singer in 1975. The philosophy of Peter Singer, who many consider the "father" of the modern-day animal rights movement, is not a "rights" philosophy at all. "Animal Liberation," a seminal work, calls for humans to consider the "interests" of all sentient beings ([Bartlett 1991](#)).

Since 1975, many other departments of philosophy and religion have picked up the battle cry. Early Christian churches professed that animals do not have souls. Gradually, however, societies have admitted that, because animals experience pain, it is not too far-fetched to believe that they also have feelings. Until recently, human language, upright locomotion, use of the thumb, and the ability to solve complex problems were attributes humans cited to "keep animals in their place" ([Albright 1986](#)).

In his book, Singer denounced animal pain and suffering while supporting freedom for animals. He also defined a new form of prejudice called "speciesism." He defined speciesism as a prejudice or an attitude of bias toward the interests of members of one's own species and against the members of other species. To avoid speciesism and cruelty to animals, Singer espouses vegetarianism as a form of boycott as well as a lifestyle. The preface to the second edition of "Animal Liberation" ([Singer 1990](#)) states, "The strength of the case for Animal Liberation is its ethical commitment; we occupy the high moral ground and to abandon it is to play into the hands of those who oppose us." The book has had an enormous impact as a forceful call to arms for the general reader, especially on the subjects of "factory farming," the use of animals in medical research, and vegetarianism as morally and socially necessary. The question of animal rights and total abolition of the use of animals in science, animal agriculture, and commercial and sport hunting and trapping also have been the subject of published works by many other philosophers ([Albright 1986](#)).

Another proponent of animal rights is philosopher Tom Regan ([Regan 1983](#), [1989](#); [Regan and Singer 1976](#)). Regan's book, "The Case for Animal Rights," could very well be called "The Case for Mammal Rights," because his use of the term "animal" seems to refer to "a mentally normal mammal a year or more in age." Regan explores the implications of the use of animals for food, the hunting and trapping of animals, and the use of animals in science:

On this view, animal agriculture, as we know it, is unjust because it fails to treat farm animals with the respect they are due, treating them instead as renewable resources having value only relative to human

interests. Animal agriculture, as we know it, is wrong, not only when farm animals are raised in close confinement in factory farms, but also when they are raised 'humanely,' since even in this case their lives are routinely brought to an untimely end because of human interests....The rights view will not be satisfied with anything less than the total dissolution of the animal industry as we know it.

In the last chapter, Regan sets forth his reasons for believing that vegetarianism is morally obligatory.

Elsewhere (1989), Regan has written: "I regard myself as an advocate of animal rights -- as a part of the animal rights movement. That movement, as I conceive it, is committed to a number of goals, including:

- the total abolition of the use of animals in science,
- the total dissolution of commercial animal agriculture, and
- the total elimination of commercial and sport hunting and trapping."

In a moralistic style of writing that Regan himself terms "disciplined passion," he concludes this article by stating that "the fate of animals is in our hands. God grant that we are equal to the task." Earlier ([Regan and Singer 1976](#)), Regan sowed seeds of doubt and suspicion about agricultural animal systems: "For the fact is that in ever-increasing numbers farm animals are being raised in incredibly crowded, unnatural environments according to what are called "intensive rearing methods." Some of the details and consequences of these methods are presented in [Peter Singer's 1976](#) essay "Down on the Factory Farm." Singer reveals that animals raised by these methods lead lives characterized by "extreme deprivation, pain and frustration."

At a 1991 animal protection symposium put on by the National Alliance for Animals, a call for the animal rights movement to distance itself from animal "welfare" was voiced by two prominent animal rights speakers: Regan, of North Carolina State University, and Gary Francione of Rutgers University Law School. Though the style and substance of their oratory was markedly different, both Francione and Regan characterized animal welfare as the "enemy" of animal rights; argued that the animal rights movement is being co-opted by proponents of animal welfare; and encouraged listeners to return to a belief in the fundamental principles of the animal rights doctrine, as articulated by Regan.

To Francione and Regan, the goals of animal "welfare" not only differ from animal "rights," they contradict them. In the words of Francione, "What you do when you merely ameliorate the conditions of enslavement is that you perpetuate the enslavement. And that is totally inimical to the goal of abolition." Regan stated that "people who work to improve the corrupt system of exploitation fail to understand this truth, a simple truth: to make injustice seem better is to prolong injustice" ([Bartlett 1991](#)).

In an attempt to consider differing points of view, the book "Animal Rights: Opposing Viewpoints" ([Rohr 1989](#)) is recommended. It presents 32 articles debating the use of animals and whether they have rights. This book considers and debates five questions:

- Do animals have rights?
- Is animal experimentation justified?
- Should animals be used for food?
- Does wildlife need to be protected?
- How can the animal rights movement improve animal welfare?

A helpful periodical bibliography and list of critical thinking activities (especially for students) are included with each chapter. The activities help students distinguish between fact and opinion, develop the ability to empathize, recognize deceptive arguments, recognize statements that are provable, and evaluate sources of information.

Drs. Rowan and Tannenbaum ([1986](#)) from Tufts University take a more moderate animal rights view. "We believe that animals have some rights and that we have important moral obligations regarding animals, but we also believe that at least some use of animals for human ends is legitimate." They conclude "...it would be most unfortunate if the concept (of animal rights) became equated with one particular political movement -- such as those seeking to abolish any humane use of animals. The concept of rights is both powerful and subtle and must be used with care and precision to

explore our relationship with and responsibility to animals."

"The philosophical animal rights debate is a question of absolutes -- either you use animals or you don't," says Curtis. "The vast majority of people in the world today have decided to use animals because they want meat and other products of animal origin. It's an issue that's already been decided in our society. The more complex issue that remains open for discussion is animal welfare, and that isn't a matter of absolutes. Animal welfare concerns our moral responsibility to support the well-being of animals. This concern always sparks angry debates, because each and every human being is going to have a different opinion about where to draw the line" ([Martz 1991](#)).

Thompson ([1992](#)) has presented an overview of animal welfare and animal rights as they relate to biotechnology. First, criticisms of the use of animals in scientific research have led to reforms, as well as constraints, and increased costs on research practices in all areas of biological sciences. Second, some potential political allies for opposition to biotechnology may lead animal activists to target the products of recombinant DNA research. Third, the potential for using recombinant DNA techniques to develop new animal genomes (i.e. transgenic animals) may raise special questions for animal well-being. Finally, the public's perception of a lack of compassion for animal interests on the part of the research community may be a component of a vague, but extremely significant, antipathy toward science in general. Opposition to biotechnology may be cited, along with the perception of scientific dishonesty that has led to public disenchantment with science and scientists. If so, a willingness to understand and take seriously the issues of animal well-being and of public attitudes toward animals will be a component of responsible science in the coming decades.

A discussion of ethical issues on the care and use of animals commonly presumes a distinction between animal welfare and animal rights, but the distinction itself has become the source of much confusion. There are at least three ways to draw the distinction. Thompson ([1992](#)) refers to political, conceptual, and philosophical objectives. He includes an ethical analysis of each.

Vegetarianism

Vegetarianism is not new. The word "vegetarian" was invented in 19th century England. Early Greek thinkers advocated a vegetarian diet in reaction to over-indulgence in animal flesh and wine. Excesses finally gave birth to the vegetarian movement in both Greece and Rome. Pythagoras (6th century B.C.) argued for vegetarianism on the basis of transmigration of souls between humans and animals. Plato (5th-4th centuries B.C.) drew sharp distinction between the rational soul of humans and appetitive soul of animals and claimed that superior rational humans naturally rule over inferior appetitive animals. He characterized animal existence as "bestial", sexually wanton, lawless, murderous, and warlike, but was sympathetic to vegetarianism as an ideal. Aristotle (4th century B.C.) claimed that animals with a lower type (sensitive) soul are meant to serve the purposes of humans, who have a higher type (rational) soul. This idea has heavily influenced to the present day a Western anthropocentric view of animals ([Magel 1989](#)).

The idea that it is morally wrong to eat animals also held sway for about 1,000 years among some of the most prominent ancient Greek philosophers. The idea died out in the Western world for almost 1,700 years. Since the 1970's, however, there has been a resurgence of interest in vegetarianism, marked by lively debates and the emergence of a substantial literature in the form of scholarly books and articles ([Dombrowski 1984](#)).

The Vegetarian Information Service, Inc. (formed in 1976) has stated that major training, mobilization, planning conferences, and animal rights actions are being held. Their major objective is to promote vegetarianism and animal rights.

Alex Hershaft ([1982](#)), founder of the Farm Animal Reform Movement, president of the Vegetarian Information Services, and former editor of the "Vegetarian Times," has written about the emerging structure of the vegetarian and animal rights movement in the United States as follows:

...Where 1970 had begun the shift of public consciousness toward life-enhancing ideologies and 1975 sparked an explosive growth of the vegetarian and animal rights movements, 1980 was the year for reassessment and consolidation. At the same time, animal rights loomed as a prime candidate to become

the major cause of the 1980's, just as civil rights and women's rights had been in the 1960's and 1970's. In fact, most animal rights advocates were graduates of those movements and viewed animal rights as a logical extension of those ideologies. Most importantly, ethical vegetarians and animal rights advocates discovered that, despite their diverse origins, their ideologies were one and that they had much more in common with each other than with the traditional wings of their respective movements. The fresh idealism and excitement of animal rights advocates provided a fitting complement to the experience, resources, and credibility of ethical vegetarians. Clearly, the time had come for the two movements to merge and to make a major impact on the social and economic fabric of American society. It was precisely with this goal in mind that, in the summer of 1980, we formed Action for Life -- a framework for arranging conferences and seminars to train and mobilize animal rights and vegetarian activists.

Lehman and Hurnik (1980), Department of Philosophy and Department of Animal and Poultry Science, respectively, at the University of Guelph, Ontario, Canada, prepared a paper entitled "On an Alleged Moral Basis of Vegetarianism." They formulated the argument (called the vegetarian argument) for the conclusion that it is wrong to kill animals for food. If this argument is acceptable, they said, then so is a parallel argument that it is wrong to kill plants for food. The parallel argument is not acceptable, and thus the vegetarian argument is not acceptable. Other basic premises of the vegetarian argument are discussed and challenged in their guest editorial.

Kathryn George (1990), Department of Philosophy at the University of Idaho, argued that the vegetarian ideal as a social goal for all would be wrong because it fails to consider the individual nutritional needs of humans. These needs vary throughout the stages of life with biological differences between the sexes and the eugenic effect of limiting the adaptability of the human species. She identified seven classes of individuals, comprising most of the earth's population, not required to be or become vegetarians.

There are many kinds of vegetarians. Hershaft has already alluded to ethical vegetarians. Does that mean that they are vegans and consume only plant sources? Some draw the line as lacto-ovo vegetarians (dairy products and eggs, respectively). There are pesco-vegetarians (fish), fruitarians ("nutterers") who consume only those plant sources that are ripe or mature (i.e. fruits, grains, and nuts).

Morris (1990) states eloquently that:

We humans, as evolved carnivores, have the right to live by our natural diet. Mankind is irreversibly adapted to a diet that contains meat as a major constituent and is no longer suited to a predominantly vegetable diet. Proof of this comes from those struggling peasant populations where meat is in short supply. Populations forced to suffer a low-protein, high-carbohydrate diet for prolonged periods eventually succumb to cirrhosis of the liver, pellagra, beriberi, kwashiorkor, and other serious deficiency diseases.

George Bernard Shaw, one of history's most famous vegetarians, is often cited as an example of a man who lived actively into his nineties through his special diet, but the truth is that he survived despite it, not because of it. Serious anemia, caused by his vegetarianism, was threatening to kill him at one stage and he could only be saved by accepting medication that included liver extracts. This made the leaders of the vegetarian movement furious and they savagely attacked the elderly playwright, apparently caring more for principles than for Shaw's continued survival. Shaw wrote a withering reply, in which he made the crucial point that the value of vegetarianism is greatly diminished by the fact that it is so difficult and expensive to do well, ending with the comment: "The so-called simple life is beyond the means of the poor."

For those who have not studied the problem this may be difficult to understand. Vegetables are cheaper than meat, but the problem is one of balancing the intake of vegetables in order to produce, by human cunning, the amino-acid balance so amply offered by every piece of meat. Different vegetables possess different essential amino acids, but not in the right combination: without the perfect combination of all of them, none of them works properly in the human digestive system. This means that, to produce a safe vegetarian meal, a delicate balance based on biochemical knowledge has to be achieved, employing just the right mixture of botanical elements. This requires patience and expertise and explains why it is that, in ignorant peasant communities, the unavoidable vegetable diet causes so many serious deficiency diseases.

As things are at present, an efficient vegetarian diet is essentially a phenomenon of the affluent middle classes. By contrast, a crudely applied vegetarian diet for the masses remains a killer.

Vegetarians are quick to point out that this need not always be so: if advanced nutritional knowledge were applied on a global scale so that a carefully balanced plant diet could be mass-produced in starvation areas, there is hope that the terrible deficiencies caused by the absence of sufficient meat could be avoided. This is clearly a prospect for the future and an important one, since it seems that in any case there will never be enough meat for everyone.

There are additional difficulties, however, because certain crucial vitamins and minerals are missing from a purely botanical diet, even the most expertly balanced one. Clearly the vegetarian movement, despite its good intentions, is fighting against nature, and its unequal struggle will continue until that far-off day when our biochemists have eventually succeeded in creating a complete synthetic diet from basic chemicals for us all to eat.

If meat is necessary for nutritional reasons, it must be admitted that its consumption makes hypocrites of many of us. Modern citizens love their joints of meat and their steaks, but how many of them would be prepared to carry out the killing, the degutting and the butchering themselves? Isolation from farming and from hunting has made us squeamish. We live in an age of specialization, when matters of life and death are kept discreetly at a distance. If we had to do the killing, many more of us would resort to the vegetarian or vegan solution than do so already. Those who market our food are well aware of this, which is why so much meat today is displayed in shapeless cellophane packets which give no hint of its natural animal origins. It is abstract food for a generation that prefers not to associate the meat it eats with the animals from which it comes.

There is nothing shameful about killing animals solely as a source of food. What is shameful, however, is the manner in which we treat many of them before we kill them. We all have to die, both humans and non-humans, but neither we nor they need to live miserable lives. There is no excuse for inflicting pain, frustration or deprivation on any of our food animals at any stage in their lives. Death may be inevitable but cruelty is not. If we must eat meat, then we must ensure that the animals we kill for our food live the best possible lives before they die. Anything less is a betrayal of the Animal Contract.

Related Issues

Further scrutiny and scientific answers are needed in response to welfare questions being raised about such issues as antibiotics in animal feeds; hormone implants; pesticides in food production; the diet-health and nutrition controversy; food safety; feeding grain to farm animals versus hungry people; environmental issues (livestock grazing, methane production, manure management, deforestation, public lands, energy use, water use, etc.); genetic engineering and biotechnology (bovine and porcine somatotropin). Responses such as "Animal Agriculture: Myths and Facts" (Animal Industry Foundation, P. O. Box 9522, Arlington, VA 22209) and "Myths and Facts About Beef Production" (National Cattlemen's Foundation, P.O. Box 3469, Englewood, CO 80155) have been formulated and distributed to interested persons.

Strategies for Change

Animal rights and animal welfare have biological, cultural, economic, social, philosophical, emotional, political, legal, and policy dimensions. Hundreds of organizations are active in some aspect of these issues. Viewpoints range in a continuum from animal rights advocates to livestock producers ([Getz and Baker 1990](#)).

The animal welfare issue is not going to go away. Continuing to cloud the issue is the subject of animal rights along with humane care and treatment, especially of laboratory (research) animals. The present-day animal rights movement has civil disobedience precedents, starting with Thoreau and continuing through Gandhi, Martin Luther King, Viet Nam protesters, and anti-abortion activists. Similar to the environmental movement, widely divergent differences about animal care and well-being seem to be headed toward regulations and legislation ([Albright 1986](#)).

Before 1991, 12 States had enacted legislation prohibiting individuals from entering an animal facility with intent to destroy property or injure animals. Since that time, other states have passed similar bills. States with legislation include Arkansas, Arizona, Colorado, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Minnesota, Missouri, Montana, Nebraska, New York, North Carolina, North Dakota, Oklahoma, Oregon, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington and Wisconsin. Although each State's bill is somewhat different and legislation in some States does not include agricultural facilities, it is interesting to see how the momentum has shifted toward such legislation. Only a few years ago such action would have been viewed as unnecessary.

Legislative activity is not limited only to States. The Animal Enterprise Protection Act of 1992 was signed on August 26, 1992, by President George Bush. Congressman Stenholm (D-TX) said in his introductory remarks: "Criminal terrorist activities will continue unless the full power of the legal system is used." The bill was sponsored in the Senate by Senator Heflin (D-AL). Need for such national legislation was brought to light when it was revealed that more than 100 acts of terrorism, vandalism (including animal liberation), and other illegal acts had been reported in the United States in recent years, yet only one conviction had resulted. Current laws do not adequately cover this type of illegal activity. ([Johnson 1991, 1992, 1993](#); [Kopperud 1991](#)).

[Geoffrey S. Becker](#), Specialist, Environmental and Natural Resources Policy Division, prepared a 43-page report for Representative Stenholm on State and Federal laws relating to the welfare of farm animals. In summary, the report states:

Animal protection activists in the United States are seeking modifications (or even curtailment) of many practices long considered acceptable and necessary to animal agriculture. Examples include rearing large numbers of cattle, hogs, and chickens in close confinement; performing surgical procedures such as castration, tail-docking, or beak-trimming; housing layer hens in cages; and isolating veal calves in crates.

Currently, no Federal law prescribes standards for on-farm handling and care of animals, although two statutes do address the humane transport and slaughter of livestock. All States have anti-cruelty laws, which can -- but do not always -- cover farm animals. Many States regulate the transport and slaughter of farm animals, but few if any address on-farm activities.

Recent surveys suggest that most people still support agricultural uses of animals (as do many animal protection groups), and they believe that farmers generally treat their animals humanely. However, many also appear to support some government regulation to insure humane treatment, the surveys suggest.

Animal agriculturists insist they are concerned about and understand their animals' welfare needs and would be economically foolish to ignore them. They express worry about misguided efforts by uninformed critics that could lead to the imposition of mandatory, unworkable regulations harmful to producers and animals alike. Producer education and voluntary guidelines are more effective ways of assuring animal welfare, they believe.

But many animal protection groups contend that producers' efforts fall short, in part because today's intensive farming systems perpetuate standard practices that may be harmful to animals' well-being. (The more radical animal 'rights' groups believe man has no right to use animals for any purpose.)

Conventional agricultural interests have always deployed strong scientific and economic arguments in defense of their industry. However, the 98 percent of the population no longer residing on farms holds an extremely wide range of moral and religious beliefs about man's relationship with other animals -- which ultimately could carry more weight in future policy decisions than traditional economic and scientific arguments ([Becker 1992](#)).

GLOSSARY

Abuse -- Obvious cruelty; striking or willfully harming an animal with a club or instrument of harm.

Ahimsa -- Doctrine of non-violence or non-killing (from Sanskrit a without, himsa injury); Hindu, Buddhist, and Jainist philosophy.

Animal husbandry -- The proper breeding, feeding and care of animals, especially farm animals. Some modern dictionaries substitute the word "science of" for "proper" in the definition. Unfortunately, the term "husbandry", fell from grace about 30 to 35 years ago. Universities substituted "science" for "husbandry" in the names of animal, dairy, and poultry departments. Position titles were changed to create "animal scientist." At the same time, an emphasis on basic research and an overt de-emphasis on husbandry-related issues were initiated. The trend continues.

Animal rights -- The concept that animals have rights that are equivalent to, or even supersede, those of humans; implies that animals should be used for no other purpose than for the benefit of the animals themselves.

Animal welfare -- The concept of using animals for human ends but minimizing pain, stress, suffering, and deprivation and enhancing the animals' well-being during their lifetimes.

Anthropomorphism -- Ascribing human traits to animals, gods, etc.

Confinement -- Imprisonment; restriction of freedom.

Cruel -- Having or showing indifference to or pleasure in another's suffering.

Deprivation -- Loss of desired thing; refers to implied cruelties such as limiting an animal's freedom or association with others of its kind.

Ethology -- The study of behavior of animals in the wild, under conditions of domestication, or in the laboratory for the purpose of confirming field observations. Emphasis is on the evolutionary perspective, particularly the adaptiveness and modification of behavior for the animal's natural environment, be it the wild, zoo, farm, laboratory, or home. This information aids in appraising animal health and welfare.

Liberation -- Setting free.

Neglect -- Denying a vital requirement such as food, water, or shelter to an animal under one's care.

Protect -- Keep safe, defend, or guard a person or thing from or against danger.

Speciesism -- A prejudice or bias toward the interests of members of one's own species and against the members of other species.

Vegetarian -- Persons who do not eat meat, poultry, and fish. Vegans are vegetarians who abstain from eating or using all animal products, including milk, cheese, other dairy items, eggs, wool, silk, or leather.

Vivisection -- Act of operating or experimenting on living animals for medical or scientific research.

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Many of the above videos are available from:

**Animal Welfare Information Center
USDA, National Agricultural Library
Document Delivery Services Branch, 6th Floor
10301 Baltimore Blvd.
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Animal Welfare Issues:

ANIMAL EXHIBITS, SHOWS, AND FAIRS

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INTRODUCTION

Shows, fairs, and exhibitions have become annual traditions in many parts of the country. As the general population has shifted from rural to urban, with less than 2 percent of Americans now living on farms, the majority of spectators are now urban dwellers. It is extremely important to recognize that fairs, shows, and exhibitions represent the only direct contact that many urban dwellers have with farmers or farm animals.

Local, county, State, national, and international fairs, shows, and exhibitions have provided the format within which significant genetic selection decisions have been made for many domesticated animals. Judges who are experts in rating animals according to current industry or breed standards rank individual animals from "best" to "worst" in a series of classes. The economic value of breed and show champions, as well as their relatives and descendants, is enhanced by this process.

Although these gatherings have for the most part been open to the public, in years past a large proportion of the observers had a direct interest in the outcome of the animal judging competitions. This was particularly true of rural agricultural fairs where producers gathered information to make decisions on breeding stock purchases for the following year.

With the increasing use of performance testing and the availability of ultrasound and other noninvasive techniques for accurately determining body composition, the value of show ring evaluation as a genetic selection tool has diminished and will continue to do so. Due to decreased entries, some urban fairs have replaced traditional show ring competitions with live-animal educational exhibits and demonstrations. The tradition of culminating 4-H and FFA projects with live-animal exhibitions is likely to continue, but these exhibitions represent only the final stage of the educational process built into the youth projects. The opportunity for youth to demonstrate what they have learned and accomplished is probably more important than the genetic evaluation aspect of the exhibition.

DISCUSSION

Benefits of Exhibits, Shows, and Fairs

A well-planned animal exhibition should be an educational experience for both participants and spectators. Animal care and management at the show site should reflect the best management practices routinely carried out at home. County Extension agents and State Extension specialists provide educational information about care and management of animals. They can also provide information about unique conditions encountered in show situations. It should always be remembered that fairs and other animal exhibitions are the windows through which urban dwellers and the general

public view animal agriculture.

Training and preparation for the show and for the associated fitting and showing competitions yield great benefits in promoting direct contact and interaction between youth and their project animals. But the competitions may have been over-emphasized with respect to the overall goals of the youth projects. In some counties and States, the auction sales associated with the 4-H fairs and shows are big dollar events, with champions selling for 10 to 20 times their commercial market value.

The profits associated with show ring champions have spawned an industry devoted to producing potential champions. Some youth are able to purchase higher priced show steers, club lambs, club feeder pigs, dairy calves, etc. from breeders who produce animals that will catch the judges' eye. In addition, illegal or unethical chemical applications, surgical techniques, and physical training regimes to increase muscle size and definition are sometimes used to artificially enhance the appearance of show animals. Blood and/or urine testing of champion animals is now routine at some shows to discourage attempts to use unacceptable practices. Show rules must ensure that physical or chemical abuse of animals will result in immediate disqualification.

Animal Handling and Care

Although most exhibitors have received training on the farm or as part of their project and are good animal handlers, those involved in such things as sheep-shearing contests, herding animals for transport, and similar activities may appear to be handling animals in an unacceptable manner. Extension personnel and show officials who are involved should caution and offer instruction to exhibitors and competitors who might mishandle animals, and be prepared to intervene if animals are being abused. It is also important to take the time to explain to spectators proper handling and management techniques and the reasons for them.

If animals are injured in any way, they should be attended to immediately. Minor cuts or wounds should be treated by exhibitors. Animals with more serious injuries or illnesses should be treated promptly by a veterinarian. The show management should have a veterinarian on duty or on call at all times.

The management should regularly monitor livestock housing areas for possible overcrowding, frequency of stall cleaning, amount of bedding, and methods of livestock restraint, and should make sure all animals are regularly fed and watered. In addition, show management should be alert for any practices that are unacceptable or that could be perceived by the general public as being unacceptable.

Animal Activists

Nearly all people who work with animals and show them are aware of the growing size and impact of the animal activist movement. Several national animal activist organizations have state and local affiliates, and many are well financed. They conduct extensive educational and public relations programs, employing famous people as spokespersons. They may have individual agendas and compete for financial support, but they often work together to influence legislatures, corporate boards, and other public policy decision makers.

While often thought of as a unified effort, in reality the animal activist movement is made up of many groups with widely differing philosophies. The more extreme groups are against the use of animals for any purpose; on the fringe are those who are against even the keeping of pets.

More moderate animal welfare or protectionist groups recognize that plants and animals serve each other's needs and that human use of plants and animals is justifiable and natural. However, most animal protectionist groups want humans to use fewer animals and keep animals in conditions that are less confining and more "natural." Their main goal is to make sure animals are raised, handled, and slaughtered or euthanized as humanely as possible. Farmers and others who work with animals have much in common with these organizations and should communicate with them more effectively.

Strategies of some of the more radical activist groups include acts of civil disobedience during public demonstrations, as

well as illegal raids on animal facilities to destroy property and steal animals. Legislation passed in 1992 (Animal Enterprise Protection Act of 1992) gives Federal protection from such illegal acts against animal facilities, including those used for animal exhibitions.

Preparing for and Dealing With Activists

Livestock shows and sales are easy and effective places to focus public attention. Show managers, FFA advisors, and 4-H leaders should prepare for upcoming fairs and shows by knowing what local animal activist groups advocate, how they operate, and how to proceed if demonstrations occur. Overall site security should be evaluated and increased if necessary.

If animal rights demonstrations are expected, show managers should designate an even-tempered, knowledgeable individual to take charge and to serve as a spokesperson. This lead person may be the show manager, livestock superintendent, member of the fair board, or other responsible person.

Other individuals should be assigned by the lead person to monitor demonstrators' activities while they are on or near the show grounds. Monitors should:

- Observe demonstrators to see that they conduct their demonstration lawfully.
- Inform the lead person if there is a reason to notify the police.
- Discourage the more vocal and confrontational show personnel and participants from interacting with demonstrators.

If trouble is anticipated, the lead person may find it useful to inform local police ahead of time so they can have units in the vicinity. Any communication with police **must** be coordinated with officials in charge of the show and the persons in charge of the facility where the activity is taking place.

Avoiding confrontations is of utmost importance. Animal activists who picket or demonstrate at livestock shows or sales are not there to try to change exhibitors' minds about raising livestock; they are there primarily to influence the attitudes of the general public. Anything that calls attention to their actions gives them publicity and could turn the activity into a media event. It is best for those involved with the show to avoid arguments and to give positive responses with facts. This is often best accomplished by directing demonstrator and media questions to a single spokesperson.

Remember that everyone has a legal right to express his or her opinion as long as they obey the law. However, no one may enter private property without permission or disrupt properly scheduled events staged in public areas.

Although group members should not confront demonstrators, the demonstrators might move from the demonstration area to confront individuals. If they disrupt ongoing activities, they should be asked to stop. Under no conditions should physical force be used against the demonstrators. If demonstrators are unlawfully disrupting planned activities, inform the lead person.

The lead person may find it useful to speak with the demonstrators to find out who their leaders are and what organizations they represent. It is important to use common sense and not get angry or call the police prematurely. A businesslike approach might allow the lead person to work out some "ground rules." It could also provide an opportunity to inform the demonstrators of the purpose of the group's activities and permit them to get to know the group. People who know and respect each other have a better chance of getting along, despite their differing philosophies.

Keep Animal Activist Issues in Perspective

Although radical activists receive much attention and press coverage because of their tactics, their numbers are actually very small. Of far greater significance is the much larger group of people who use animal products but who have legitimate consumer concerns about how those products are produced. Not everyone who asks probing questions will be an animal rights activist. Most contacts will be with people who are trying to find out more about how animals are

raised and used. Take the time to answer their questions and explain what is being done and why.

CONCLUSION

One of the primary purposes of youth animal projects is to train today's young people to be tomorrow's responsible adults. 4-H and FFA members learn and practice the best ways to house, feed, manage, and care for animals. Project members work closely with small numbers of animals. This allows them to get to know animals as individuals, to gain a real appreciation for their needs and welfare, and to feel the loss associated with marketing an animal. Youth programs are probably society's best hope for producing future farmers who are aware of and sensitive to the needs of the animals under their care.

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Animal Welfare Issues:

RESPONSIBLE CARE AND HEALTH MAINTENANCE OF FISH IN COMMERCIAL AQUACULTURE

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INTRODUCTION

Production agriculture has enabled the United States to become the best fed society in the world and is vital in domestic and international trade. An important segment of production agriculture, livestock production, has successfully provided consumers with a low-cost, wholesome protein source. Consumers have dictated low prices and high quality. Consequently, to maintain competitiveness, producers have set management objectives that maximize production while minimizing costs. In addition to public concerns about cost and wholesomeness of animal products, there is growing concern for the well-being of the animals while in the care of the producers. Most animal farming systems are designed

to maximize production; however, proper care and good husbandry practices are linked not only with high productivity, but also with animal health and well-being. Producers must make a conscious effort to ensure the well-being of animals in their care. The argument is often made that attention to animal welfare can adversely affect profitability. In most systems, however, improved health and well-being translate into better animal performance. Both animal welfare and environmental quality protection are the responsibility of producers, and appropriate management inputs should be factored into production costs. If production costs increase significantly, the consumer will either have to pay higher prices or face limited supplies caused by producers being forced out of business.

Aquaculture, the raising of animals or plants in an aquatic environment, has received considerable attention during the past two decades as an alternative farming practice. Aquaculture has enabled society to enjoy fish for food, pets, and recreation and contributes to the preservation of certain threatened aquatic species. Concurrent with aquaculture development, concern for the welfare of the animals grown in aquatic systems has become an increasingly important issue with certain segments of society. The goals of the aquaculturist and concerns over animal welfare are not necessarily at odds. With careful planning and proper management, fish can be cultured to meet production and profit goals while maintaining aquatic animal health and well-being.

Both the general public and the producers must understand the needs and health status of the animals being produced. However, concern should be based on scientific facts about the animals' well-being and not solely on perceptions. It is generally easier to identify with the welfare needs of animals that are more closely related to humans, such as primates and other mammals. Understanding of the well-being and care of lower vertebrates, such as fish, is usually less. Assessment of animal well-being should be based on subtle behavioral and physiological changes as well as established environmental limits.

The number of aquatic species is vast and their needs vary greatly; this publication addresses primarily finfish. New species of fish from the approximately 20,000 species worldwide are being evaluated and adopted as candidates for aquaculture. The optimum health requirements for major farm-raised species are known. However, requirements for other species are being determined by ongoing research that aims at defining the unique limits of each. Consequently, the amount of information available concerning health requirements varies considerably depending on the species. An understanding of the health requirements for a species increases with the length of time it is commercially cultured and its economic importance. We know much more about how to evaluate the well-being of traditionally grown species, such as channel catfish, goldfish, fathead minnows, golden shiners, and rainbow trout than we do about newer aquaculture species.

This document describes some basic requirements of cultured finfish and suggests management strategies to help ensure their well-being. It describes aquaculture systems and discusses how fish sense and react to the external environment and respond to stressful conditions. Additionally, it presents management options that can effectively address both the goals of commercial production and the well-being of the fish being produced. It is intended to provide aquaculture producers and the general public with scientifically based information on which to base procedures for the care and husbandry of aquatic animals raised in commercial production systems.

Finfish Aquaculture Classifications

Finfish aquaculture is commonly classified according to (1) consumer use of the farm-raised product or (2) the environmental requirements of the fish being produced.

Consumer use

- The largest group based on consumer use is food fish, with the goal being a wholesome food product for human consumption.
- Another category is baitfish, with the goal of producing a fish that is healthy when it reaches the user (sports fishermen).
- Ornamental fish for pet markets are also produced on aquaculture farms. Appearance and health of these fish are very important.
- Fish are also grown for restoration and mitigation of wild populations. The goal is to replenish fish stocks for

recreational fisheries or to supplement stocks of threatened or endangered species. Maintaining a diverse gene pool is important to help ensure the long-term survival of the stocks when they are released into the wild.

Environmental requirements

Aquaculture classifications based on the environmental requirements of the fish being cultured commonly use the criteria of water temperature and salinity. Each classification has an optimal range of environmental conditions where a fish species thrives and a larger range where they survive.

- Categories based on temperature tolerance include coldwater, coolwater, warmwater, and tropical fish species.
- Salinity categories consider tolerance and restrictions based on the ionic strength of the water. These categories include saltwater, freshwater, and brackishwater fish species. Some fishes, such as anadromous species (having a portion of their life cycle in both fresh and salt water), are comfortable in a wide range of salinities and may appear in more than one category.

While these classifications are somewhat arbitrary, they are helpful when discussing basic environmental requirements and the well-being of fish grown in different aquaculture settings.

PRODUCTION SYSTEMS

Regardless of the type of aquaculture based on the previous classifications, fish can be cultured in many different systems. Each type of system can have different effects on cultured animals. To address the management inputs required to maintain the health and well-being of the fish within a system, it is important to understand the type of system in which the fish are grown. Each of these systems has specific sets of conditions that can be controlled by the producer, resulting in a graded level of management responsibility.

Pond Culture

Pond systems may be classified by the level of intensification or the degree of management necessary to produce the quantity and quality of fish desired. The least intensive system offers the producer few control options, and management requirements are low. Management inputs include stocking and harvesting control to establish a balanced relationship between predator and prey species (i.e. a bass and bluegill sunfish pond). The major management strategy is to control the species ratios of the original stocking and to control subsequent harvests. The productivity of fish in the culture system depends on the natural fertility of the pond.

The next level of intensification involves the use of inorganic fertilizer, consisting of nitrogen, phosphorus, and potassium (NPK). Management efforts are similar to those described previously, but now the fertility and production of the pond are enhanced. The fertilizer increases production of plants (primary productivity) and of the small aquatic animal life that feeds on these plants. This increased food supply results in as much as a five-fold increase in fish production.

The productive capacity of the system can be further increased through supplemental feeding. By providing commercial feed, the number and weight of fish per unit volume of water can be greatly increased. The factor limiting production is usually dissolved oxygen. Oxygen supply usually limits the total weight of fish to about 1,500 pounds per acre per year. While the weight limit varies by species, the likelihood of oxygen depletion increases as the total weight of fish increases. It is common at this level of intensification and management to grow a single species of fish. Stocking, reproduction, and feeding rates are managed to ensure that overpopulation or excessive fish weight does not create high-risk conditions.

Management at the next intensification level includes greater control of dissolved oxygen, with the objective of obtaining even higher production rates. This type of system may accommodate 5,000 to 10,000 pounds of fish per acre, depending on the species grown and the availability of water quality management equipment. Greater inputs of feed cause increased production of waste products by the fish. If the dissolved oxygen is managed effectively,

nitrogenous waste products produced by the fish usually become the next production- limiting factor. If stocking and feeding rates are not carefully controlled, the concentration of un-ionized ammonia and nitrites can increase to undesirable or dangerous levels. Nitrogenous waste becomes a limiting factor because of the limited capacity of the pond biota (primarily algae and bacteria) to convert the waste products into less harmful byproducts. The amount of nitrogenous compounds that can be effectively processed and removed on a daily basis in this type of system is about 3 pounds of nitrogen per acre per day. This translates into about 100 pounds of 32-percent protein feed per acre per day. These values can change with different climates, environmental conditions, and fish species.

All of the systems described thus far are pond culture systems that require little or no water exchange. They rely on physical, microbial, and/or photosynthetic processes to remove waste products released by the fish.

Intensive Culture

Other aquaculture systems for commercial and research use require specific management practices and typically contain aquatic stocks of high density. These systems are referred to as intensive culture systems. Fish density is usually expressed in number of fish or weight of fish per cubic foot of water and/or by the flow rate. These intensive culture systems require the highest degree of management, which is aided by system design. Intensive culture systems include net pens or cages, raceways, and recirculating systems.

Net pen or cage culture systems involve the stocking of high numbers of fish per cubic foot into enclosures placed in large bodies of water. Water quality management within the cage is one of the primary tasks of the producer. For good water quality, water must flow through the cage at a rate sufficient to remove the water containing the fish wastes and replace it with cleaner water containing suitable concentrations of dissolved oxygen. The next management task is to ensure that the fish are stocked at the proper density. This provides for adequate lateral swimming space and limits aggressiveness resulting from dominance behavior. Under good management, certain fish species (i.e., catfish) can be grown at densities as high as 10 pounds per cubic foot of enclosure. Another important management strategy is making sure that the fish are fed a "complete" diet -- one that contains all the essential nutrients. The quality of the feed used in any intensive culture system is critical because the fish have limited access to natural food sources.

In raceway production, continuously flowing water provides fish with a high-quality environment. The water flows through the system and is discharged before the water quality degrades. Fish density of a raceway system is determined by the flow rate and quality of the incoming water. Stocking rates are high in these systems, and the lateral swimming space requirements for each species has to be known. Water flow velocities must be maintained below a critical level to avoid excessive exercise, which can cause stress. Trout, for example, are commonly grown at densities as high as 2 to 3 pounds per cubic foot of water and catfish at 10 to 15 pounds per cubic foot of water without any adverse effects, if suitable water quality is maintained. Supplemental aeration and oxygen injection are commonly used to enhance production in raceways. Because water quality is controlled more by physical factors than biological factors, problems that result from environmental stressors are usually limited. Generally, problems in raceway systems are caused by system failure (reduction or cessation of water flow) or the introduction of disease organisms into the facility.

Recirculating culture systems can be complex and are the most difficult aquaculture system to manage. The usual intent of this culture method is to limit new water inputs to about 5 to 10 percent replacement per day. Such control attempts either to control water temperature within a specific range or to limit water usage. The water that flows through the tank or trough is collected and filtered both mechanically and biologically to remove waste products before returning to the fish culture unit. Though the basic principle of this type of system is sound, backup systems are required to maintain water movement and quality within established critical limits. The most common problem with this type of system is biofilter overload or failure. Additionally, health management can be difficult because practical, legal applications of certain chemicals and drugs are constrained by unique functional features of the system.

Most compounds that will control disease agents also have a detrimental effect on the bacteria that are responsible for removing or converting waste products to nontoxic forms within this system.

FISH AND THEIR ENVIRONMENT

Sensory Reception and Response

The nervous system of fish is similar to that of birds, amphibians, reptiles, and mammals. Their central nervous system consists of a brain and spinal cord capable of receiving and reacting to external stimuli. The central nervous system receives information from the external environment via sensory organs and peripheral nerves. The information is processed in the brain or spinal cord, and the appropriate reactions to the stimuli are initiated. The nervous system transmits both voluntary and involuntary signals to control the action of muscles and glands. Upon stimulation, the nervous system and the endocrine glands integrate to control functions and processes such as feeding and digestion, reproduction, respiration, circulation, osmoregulation, growth, excretion, buoyancy regulation, avoidance behavior, disease resistance, and even body temperature.

While most of the endocrine and nervous system functions found in land animals are also found in fish species, there are important anatomical, physiological, and biochemical differences. A major difference between mammals and birds and most species of fish is that fish cannot control their body temperature. The temperature of a fish varies with the temperature of the water; thus also do its biochemical, physiological, and behavioral responses. While there is some variation, fish generally double their metabolic rate for each 10 °C rise in temperature, within their acceptable range. This becomes important when assessing the health of fish that appear listless, a common response to low temperatures.

An understanding of how fish perceive their environment is helpful when managing their care properly. Fish are finely attuned to their environment by the senses of taste, touch, sight, smell, hearing, and additional senses unique to fish. Sense organs of fish are adapted for life in an aquatic environment and have many sensory structures and functions that differ somewhat or completely from those of land animals.

Sensory functions of fish can be grouped according to the type of physical or chemical stimuli that are detected. The detection of chemical stimuli by the senses of smell and taste may overlap because water is very different from air as a means of transport for chemical substances. Some fish have taste buds on their body that detect the taste of food at a distance. The sensitivity of detection increases as the fish gets closer to the food source. This allows them to locate food even under conditions when it cannot be seen. Fish also have sensory organs called nares, which are similar in structure and function to those in nasal passages of land animals, but it is the water rather than the air that carries the smell.

The perception of physical disturbances by fish is also different from that of higher vertebrates because the density of water is greater than that of air. Orientation and pressure recognition, along with buoyancy control, are important parts of a fish's physical sensory capacity. Hearing in fish is different from land animals because sound waves are received in a liquid medium, and there is no need for specialized structures to translate sound waves from the air to liquid (the ear drum). There is also little need for the external structures that are used in land animals to concentrate sound waves from the air. A fish's lateral line system, which is a sensing system for low-frequency pressure waves, can be thought of as "touch at a distance." This system provides fish with important information about food or predators while some distance away. Additional sensory capabilities in some species can recognize and react to very low levels of electricity. The organs that receive the electrical impulses from the water help the fish to find their prey and avoid predators. This can be important when considering the possible effects of stray electrical currents that can occur in fish culture units.

Sight in fish is similar to vision in land animals. Lens shape varies considerably among species, but the eyes are functionally similar. In some fish species, the small pineal gland in the brain has sensory function in light perception. This function is thought to be responsible for circadian rhythms (biorhythms based on a 24-hour cycle) that control maturation and spawning activity. These senses may require the regulation of light intensities and daily light/darkness regimes to avoid stress in fish.

We do not know the extent to which fish perceive pain as a sensory function. We do know, however, that when fish are presented with conditions that cause pain in humans, they display an avoidance behavior. Pain, as defined in Webster's New World Dictionary, is "a sensation of hurting or strong discomfort, in some part of the body, caused by an injury, disease, or functional disorder, transmitted through the nervous system." The difficulty in assuming similarities between what fish experience and what humans experience is based on our inability to find structures in fish that are similar to those known to sense pain in humans. It is also impossible to ascribe to fish the process of conscious

recognition of pain so well developed in humans. While evidence that fish have pain receptors identical to mammals is disputed ([Nickum 1988](#)), their ability to identify irritants appears to be well documented. Thus it appears important to avoid conditions that cause a violent response from fish or more subtle physiological changes that are indicative of stress.

It is impossible for humans to understand completely how fish perceive and respond to their environment. Some differences that are not part of our own experiences are how fish perceive acoustical and electrical stimuli and their ability to taste the environment with external taste buds. Possibly even more difficult to understand is how fish perceive touch. An important question to answer might be whether fish have the ability or need to discriminate between tactile stimuli that humans describe as "pleasurable" or "painful." This question is certainly important when considering the well-being of higher vertebrates that have the ability to display their pleasure or discomfort. Because we do not understand the fish's perception, a prudent policy would be to assume that conditions that cause pain in higher vertebrates should be avoided with fish whenever possible.

Environmental Stress and Disease

Fish, like other animals, have both generalized and specific responses to prolonged or repeated exposure to less than favorable environmental conditions. In a manner similar to other vertebrates, fish respond with a specific set of biochemical and physiological changes that help them survive adverse conditions. Some of the changes that occur when a fish is exposed to a stressor are similar regardless of the type of stressor. The types of stressors that can occur in aquaculture are chemical, physical, or behavioral. Because the net effect of a stressor is costly to the fish's energy, stressful environmental conditions become costly to the producer and may result in lower production efficiencies and a poor survival rate.

The overall effect of a stressor on an animal depends on the nature of the stressor and the degree and duration of exposure. Three recognizable stages are common in animals forced to tolerate sub-optimal conditions: a **stage of adaptation**, a **stage of recovery**, and/or a **stage of exhaustion**. The degree and duration of the stressor generally dictates the outcome of the "stress event." If the stress event is limited, fish are often able to adapt to the conditions and reestablish normal function under the new set of conditions. If the stress is removed, fish will generally go through a process of recovery, where they reestablish normal function over a period of time. If the stress is too great for the fish to compensate through adaptation, the fish will enter the stage of exhaustion and eventually die.

Even if fish recover from a stressful experience, important physiological and immunological changes can cause the animal to become more susceptible to disease organisms. The response pattern of fish is less understood than that of mammals and birds, but its key elements are similar. The basic response of fish to a stressor or adverse condition is to adopt an emergency survival status. While some of the responses that occur have obvious benefits to the fish, such as mobilization of energy reserves, other responses appear to have negative effects on long-range survival, such as decreased immune function. It appears that when fish are presented with a stressor, they sacrifice long-term survival strategies to concentrate their efforts on short-term survival.

The overall effect of a stressful environment to fish stocks is reduced performance. Reduced performance may be measured in poor survival, poor feed conversion rates, poor reproduction, and poor feeding and growth. Thus, raising fish in sub-optimal conditions is not to the advantage of the aquaculturist. Understanding the environmental requirements of the fish species and providing proper care and health maintenance to avoid stressful conditions are the keys to the success of the producer and the well-being of the fish.

RESPONSIBLE MANAGEMENT

The basic requirements for the well-being of fish that are raised in an aquaculture facility must be provided by the producer. While fish in the wild are capable of migrating and changing behavioral patterns to meet their needs, fish in an aquaculture facility often cannot seek out optimum or more suitable conditions. To provide fish with a healthy environment, it is important to have both a properly designed facility and a management plan that addresses the needs of the fish. Fish should be provided with their basic needs: sufficient lateral swimming space; good water quality; a

nutritionally complete diet; limited physical disturbance; and careful, prudent handling. The producer should also have a health management program that focuses on both infectious and noninfectious diseases. The program should be based on sound information and a thorough understanding of environmental requirements of the fish species and the culture system.

Because there is so much diversity in culture species and culture systems, a responsible management strategy has to be developed for individual aquaculture operations. For example, the management inputs necessary for a less intensive pond system raising an environmentally tolerant species such as the common carp would be low. However, raising the more environmentally sensitive rainbow trout in a recirculating system would require a very high level of management input. Proper management is a requirement for achieving high fish performance in any culture system. A well-designed and properly managed aquaculture facility can produce fish consistent with production goals while maintaining the well-being of the fish.

Stocking Rates

The number of fish stocked in the culture unit is very important to production goals and the well-being of the fish. Enough fish must be stocked to meet production goals but not so many that management cannot maintain proper health. If stocking rates exceed the carrying capacity of the system, then management to maintain acceptable conditions may be impossible. The influence of stocking rate is expressed in two ways: (1) effects fish have on the environment, and (2) effects fish have on each other. Greater fish densities will result in greater release of waste products into the culture environment. To avoid water quality problems associated with stocking rates, the capacity of the system to remove waste products should be understood by the producer. The carrying capacity of the system is limited by reliable physical and biological processes that have the capacity to remove specific amounts of waste on a reliable basis. Stocking rates should match the quantity of fish to be produced with the carrying capacity of the system. Additionally, the producer should provide the equipment necessary to maintain a healthy environment, and the management necessary to ensure production goals and the well-being of the fish stock.

Assuming that the stocking rate is within the carrying capacity of the system, the next important consideration is fish interactions. Most fish species of commercial aquaculture are characteristically tolerant of the presence of other fish of their own species. This is important in the selection of a candidate species for aquaculture. The lateral swimming space of high fish densities is most important in culture systems such as raceways, tanks, or cages. Depending on the species, limited swimming space may or may not cause stress. For example, catfish have been grown in cages in excess of 10 pounds of fish per cubic foot without a reduction in performance ([Davis et. al. 1991](#)). There is evidence that intermediate stocking rates of catfish (below 4 fish per cubic foot) results in fighting and injury. Thus, catfish raised in intensive systems should be stocked at rates that do not exceed the carrying capacity of the system and are above the threshold where fighting commonly occurs. Studies on coldwater fish (salmonids) have demonstrated that an elevated cortisol level (an indicator of stress in fish) is more dependent on dominance factors and inter-specific fighting than on rate of stocking ([Li and Brockman 1977](#)).

A fish's natural behavior influences its density requirement. For example, adverse effects of crowding are often experienced with open-water pelagic species and predatory species, but occur infrequently with schooling or socially oriented fishes. Consequently, naturally tolerant species are ones often selected for aquaculture. It is recommended that producers carefully investigate stocking rates to establish criteria that minimize aggression among cultured fish and maintain good water quality.

Water Quality

Management of good water quality is necessary to maintain good production and the well-being of farm-raised fish. Two sets of water quality conditions must be managed. The first set consists of factors that are generally provided within an optimal range for the culture species. Examples are dissolved ions (sodium, chloride, calcium, and bicarbonate), temperature, pH, and dissolved oxygen. The second set consists of water quality factors which, in excess, are potentially harmful to the fish and should be maintained below a specific threshold. This set can be divided into (1) external or introduced toxicants, such as heavy metals, pesticides, and supersaturated gases and (2) natural substances,

such as ammonia, nitrites, carbon dioxide, hydrogen sulfide, and suspended solids.

To maintain the health of the fish in the culture unit, it is important to select a water source that meets the requirements of the fish. A culture unit's water supply will often limit the range of species that can be grown. Not only does the ionic content of the water determine the aquatic environment where aquaculture can occur (i.e., saltwater, brackishwater, or freshwater), it can also affect management practices. For example, in freshwater aquaculture, calcium, sodium, and chlorides are very important ions to fish physiology. If they are not present in concentrations high enough for the fish to efficiently utilize them from the water, then a fish can have osmoregulatory (salt water balance) problems. The dissolved ion complex of bicarbonate/carbonate is very important in management because its buffering capacity (total alkalinity) helps control changes in water pH. While all of the important ions can be added to aquaculture water supplies, cost and logistics of such additions make certain water sources impractical for aquaculture.

Table 1. Preferred water temperature ranges for optimal growth for various fish species of different temperature classifications.

TEMPERATURE CLASSIFICATION	FISH SPECIES	OPTIMAL TEMPERATURE RANGE (C)
Coldwater	Rainbow trout	7-13
Coolwater	Yellow perch	24-27
Warmwater	Channel catfish	28-31
Tropical	Tilapia	27-32

Temperature of the source water is also very important in selection of production sites. As mentioned earlier, temperature is important in classifying aquaculture systems. Species-specific temperature requirements also make certain climates and water sources preferred for optimal growth ([Table 1](#)). While temperature of the water can be changed to meet the requirements of almost any fish species, the cost is often excessive. Rapid water temperature changes will also cause stress in fish. It is generally recommended to change the water temperature slowly at a rate of less than 3 °C per hour. This allows the fish to adapt to a new water quality condition.

The type and concentration of dissolved ions in water must be compatible with the species of fish that are grown within the system. Salinity is a measurement of the ionic concentration of water, primarily sodium and chloride. The salinity of the water greatly affects the physiology of the fish being cultured. Waters can be broadly classified into three basic categories: saltwater -- >20 parts per thousand (ppt); brackishwater -- 5 to 20 ppt; and freshwater -- <0.5 ppt. The strategy that different fish species have developed to maintain internal salt concentrations (osmoregulation) depends on the salt concentration of their natural environment. Saltwater fish have developed mechanisms that help to remove or exclude ions from internal tissues. Freshwater fish have developed mechanisms to concentrate or retain internal ions within their bodies. In fresh water, sodium and chloride should be maintained at a level of at least 10 parts per million (ppm) and calcium at 20 ppm for most fish species. Selection of a fish species that is compatible with the water source is necessary if fish are to be raised under healthy conditions.

The pH of the water in the culture unit should be maintained within a desired range (generally 5 to 9) for the health and well-being of the fish. The pH of the water is dependent on both the buffering capacity (usually total alkalinity) and the biological activity within the unit, including the fish. The buffering capacity of the water controls the degree of pH change in the water which is caused by photosynthesis and respiration. Photosynthesis by plants in the system removes carbon dioxide (the major source of acidity in most natural waters) from the water, causing the pH to rise. Respiration, on the other hand, adds carbon dioxide to the water, thus lowering the pH. The changes in pH that occur in the system are dynamic and can differ from hour to hour depending on conditions. As with other water quality conditions,

maintenance of pH within the acceptable range must be considered during facility design and managed during production.

Possibly the most important management task of a producer is to maintain dissolved oxygen at acceptable levels (above 4-5 ppm). The level of management changes dramatically with the intensity of the culture system and is also affected by the fish species raised. There are two basic approaches to managing dissolved oxygen in aquaculture systems:

- passive management, and
- active management.

The **passive management** approach is to control stocking rates so that dissolved oxygen concentrations in the water do not reach critical levels (below 4-5 ppm). Oxygen can be managed by stocking and feeding fish at low levels, as with low intensive pond culture (feeding under 30 pounds per acre per day) or by designing a raceway system so adequate water replacement keeps dissolved oxygen at desired levels. The critical level depends on the species and their health status.

The **active management** approach is to introduce supplemental oxygen by mechanical or other means. There are many different designs and approaches, but all supply oxygen to the fish at a rate that will prevent stressful conditions. The two major strategies for supplying oxygen to the fish are, (1) aeration, where the diffusion of oxygen is mechanically enhanced, and (2) oxygenation, where pure oxygen is delivered into the water. Regardless of the method used, dissolved oxygen should be maintained at acceptable levels to ensure good production and the well-being of the fish.

Of the compounds that are directly toxic to fish, the types that come from sources outside of the system (external toxicants) are the most diverse. It is necessary to prevent the occurrence of these compounds in production systems by proper site selection, water source evaluation, selection of nontoxic materials, and avoidance of any harmful contaminants.

A second group of compounds that are toxic to fish are the compounds that are produced within the system. Some of these are released by the fish as metabolic byproducts (ammonia and carbon dioxide). Others are products of decomposition of the waste products, such as nitrites and hydrogen sulfide. A third group of compounds, produced by other organisms within the system, include bacterial and algal metabolites. Fish waste products are very soluble in water and quickly become incorporated into the water. Metabolites and their breakdown products become environmental problems for the fish if released in excess of a culture system's ability to convert them to harmless forms (Table 2). When more fish are raised per unit of water, the release of metabolic wastes also increases. Fish cultured at high densities without proper waste management can cause poor water quality. This increases the risk that the water will become degraded to the point where fish will experience discomfort. The metabolic byproducts of primary concern are the nitrogenous compounds; of these, ammonia and nitrites are the most important. Proper management of waste products requires careful design of the system to ensure that the waste produced by the fish is disposed of in an efficient and environmentally sound manner. It is also important to stock fish within the waste disposal carrying capacity of the system so the system does not become overloaded. To maintain proper fish health, good water quality must be provided by source and system design and through proper management based on the needs of each species.

Table 2. Critical levels of naturally occurring waste products in fish culture

Compound	Critical Level
Ammonia	> 0.05 ppm NH ₃ -N
Carbon dioxide	>10 ppm
Hydrogen sulfide	> 0.005 ppm H ₂ S-S

Nutrition and Feeding

The complete dietary requirements for all commercial aquaculture species are not known. Generally, the longer a species has been raised in aquaculture, the more is known about its specific dietary requirements. Recommendations on the protein, energy, amino acids, essential fatty acids, vitamins, and minerals are published in the scientific literature and by the National Research Council (1983) for catfish and trout. While the feed manufacturer is usually responsible for providing feed of adequate quality, producers should know the nutritional needs of their fish. Nutritionally complete rations are required for fish reared in intensive culture conditions, while those grown in the least intensive conditions can consume more natural foods that contribute to their nutrition.

Feeding practices are also very important and can change with size and developmental stage of the fish. It is important to feed the fish on a prescribed schedule according to specific nutritional needs. The amount to be fed should be adjusted as the fish grow so they receive the proper quantity of feed daily. Additionally, temperature and water quality conditions that exist prior to and at the time of feeding can also affect feeding response. Feeding activity is a very important observation in management, and is often the first indication that one or more problems exist with the fish or in the production system. Any sudden decrease in feeding activity not attributed to natural variation (such as a change in temperature) should be investigated immediately, because it is likely that management action is required.

Physical Disturbances

Because fish are so attuned to their environment, it is important that tranquility be maintained by minimizing physical disturbances. For indoor systems, this should include provisions for necessary photoperiod (daylight cycle) manipulation and no sudden changes in light intensities. Avoidance of loud or startling noises is important. Care should be taken to not disturb fish by casting shadows over them or tapping on tanks. Care should also be taken to prevent stray electrical currents in production units, especially with highly sensitive species. Restricted access should be maintained to facilities where fish are raised in tanks to prevent excessive physical disturbances. Fish can also be stressed by excessive water velocity in raceways; the critical swimming velocity should be investigated for the species being cultured in these systems. Studies with trout demonstrate that water pH of less than 5 and more than 10 has a negative effect on the maximum critical swimming speed ([Ye and Randell, 1990](#)). The velocity of the water in a raceway should be set at a rate (usually expressed in body lengths per second) that will effectively remove wastes but does not over-exercise the fish. Excessive turbulence caused by water flow or aeration should also be avoided, especially when culturing very small fish.

Handling Fish

Handling and harvesting can cause some of the most stressful episodes in the life of a cultured fish. This is because, during handling, fish are often restrained or confined for periods of time outside water and many times are held in sub-optimal water quality conditions. It is therefore very important to handle fish as infrequently as possible and with great attention to proper handling practices. The proper salt content, temperature, and other water quality conditions should be maintained when fish are handled or transported. In some cases, approved anesthetics can be used to reduce excitement of fish during transport. This can reduce fish metabolic rates and relieve stress. The addition of salt to transport tanks for freshwater fish can also reduce the effects of stress by improving the efficiency of salt balance mechanisms. Every effort should be made to minimize the amount of time that fish are restrained or held out of water.

Health Management

Disease management in aquaculture systems begins with creating and maintaining a good living environment for the fish. Proper design and good management are necessary to minimize health risks by reducing stress to the fish. Once the system is designed properly for the and the management practices are directed to reduce stress, it is important to minimize the contact of the fish with infectious disease agents. Prevention is the best approach for avoiding diseases,

and management plans should include a vigorous health management program including quarantine, hygiene, health monitoring, and disinfection when appropriate. Treatments should be used only after a proper diagnosis of a treatable infectious disease has been made. Use only drugs and chemicals that are FDA-approved and proven to be safe and effective. Many disease treatments can have an adverse effect on the water quality within the system. Monitor water quality and be prepared to implement management action when necessary.

Disease Prevention

Disease prevention is an important part of any animal production system. Two aspects of prevention are especially important in a health management program.

- **Avoidance** -- Do not allow fish to make contact with specific pathogens. The objective is to ensure that no obligate, contagious pathogens are introduced into the facility. Management includes control of inputs, such as water supply, equipment, personnel, fish feed, and live or dead fish.
- **Stress prevention** -- Maintain the animal in a healthy and robust condition by preventing stress. Effective management of stress prevents and helps reduce the number of disease outbreaks caused by facultative pathogens, which can only become established when fish are predisposed by a stressor.

Good management practices minimize introductions of disease agents by recognizing their potential sources. The most common means of infectious disease entry is introduction of infected fish from contaminated sources. Screen new fish for important diseases that affect the species being raised. This can be accomplished in part by review of historical evidence provided by reputable suppliers and through inspection ([Thoesen 1991](#)). Quarantine the fish in an isolated portion of the facility for 4 to 6 weeks at a temperature that allows outbreaks of specific diseases. Do not share equipment with other facilities, and disinfect it between uses. Personnel should take preventive action before entering a facility or areas of a facility where they can potentially spread or carry harmful disease organisms. Buy feed from a reputable source and stored it properly until used. These practices are general, but they will help reduce the potential of disease introduction into the production system or farm.

SUMMARY

Aquaculture producers should use good management practices to ensure that the animals within the culture systems meet production goals and are cared for properly. Successful production and profitability require an understanding of the needs of the fish and the use of management practices that reduce stress. The most pressing task of new producers is to learn the specific requirements of the species selected and the limitations of their culture system and water sources. This task is easy for some commercial species and systems because of past commercial successes and available literature. For new species and new kinds of systems, however, the track record and scientific information are lacking. Prospective producers should learn as much as possible about the aquatic animal and the chosen production system. Making sure that the species selection is compatible with the culture system is the first ingredient necessary for success. The producer then must make a commitment to proper system design and management. If the information on a particular species and system is sparse, the venture will be risky to the producer as well as to the fish.

The development of procedures to assure the well-being of farm-raised fish is a dynamic process that will require ongoing research to provide new information on how to successfully culture aquatic species with minimal stress. Stress prevention, which contributes to an aquatic animal's well-being, also affects the profitability of an aquaculture enterprise. Producers should pay close attention to ensuring, through proper management practices, the maintenance of a suitable environment. Proper design and management of aquaculture systems can help ensure the well-being of the fish and production efficiencies. There are many excellent books available on the culture of aquatic organisms, design and management of aquaculture systems, water quality management, stress in fish, and health maintenance procedures. Consult with an aquaculture specialist on how to select a species and a system that has a high probability of success.

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Animal Welfare Issues:

BEEF

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INTRODUCTION

Knowledgeable beef producers, whether they are involved in cow-calf or feedlot operations, are genuinely concerned about the care of their animals. They know that cattle that receive proper nutrition and health care and that are handled correctly will perform at or near optimum. These producers make every effort to provide the best possible environment for their animals. They recognize that beef cattle should receive appropriate care during all aspects of the production cycle. These producers also are willing to speak out for guidelines that result in improved animal welfare.

If even a small percentage of beef producers provide less than optimum care for their animals, it is of concern to other beef producers, to extension educators, and to all others associated with the production of beef. It is in the best interest of everyone that beef cattle receive proper care throughout the production cycle.

This discussion paper addresses animal welfare issues that have been raised about beef production in the United States.

Animal Welfare Issues:

Are Certain Management Practices Cruel and Unnecessary?

Beef calves are generally dehorned, males are castrated, and many animals receive brands. Each of these practices inflicts some transient pain on the animal, but there are sound reasons for their use.

Dehorning is usually practiced when the animal is young and the horns are small. The pain inflicted on the individual animal benefits other animals and the people who work with cattle. Fights between horned animals can lead to injury of one or both animals, as a result of many normal daily interactions among cattle -- for example, competition to be first to obtain water or feed. Dehorned or polled animals are much less likely to be involved in fights that result in injury ([Ensminger 1987](#)). Likewise, humans who own horned cattle are at special risk from beef cows at calving time and from bulls at any time. Clearly, it is in the best interest of both the animals in the herd and the humans who work with the cattle to have them hornless. For these reasons, cattle breeders have taken the initiative to develop breeds of polled cattle. These polled breeds are very popular as they do not require dehorning and are safer for both other cattle and their human handlers.

Castration should be done at the earliest practical age. Castration causes little stress when the calf is less than 3 months old. Castration is practiced for three reasons -- to prevent physically or genetically inferior males from reproducing, to reduce the aggressive nature of intact males, and to improve meat quality. Castrated males produce meat with more marbling at lighter weights than intact males. Most male calves are castrated, but the desire to produce meat with less fat has led to renewed interest in the feeding of bulls that are marketed at young ages.

Brands are frequently applied to cattle in the Western States to provide permanent identification for animals that typically wander over large areas where they may commingle with cattle from other ranches. Branding inflicts pain for a short period of time. It is justified by the need to provide identification of ownership of the cattle. An alternative to hot brands is the use of freeze brands that cause the hair to change color. Freeze branding does not cause as much pain, and the hide is not damaged. Hot brands tend to be more permanent. Many cattle in Western States are branded, but those in the Eastern States commonly receive ear tags to provide identification. Ear tags are not a practical alternative to branding in some areas where they may become caught in trees and brush. This can cause pain and is a potential source of infection.

Does Feedlot Confinement Result in Stress for Beef Cattle?

Beef calves typically remain with and suckle from their dams until they are about 7 months old. They may then move directly to a feedlot, be placed on backgrounding diets (diets that contain large amounts of forage and result in moderate rates of gain), or be fed forages for about a year before they move to feedlots as yearlings. Calves that enter feedlots after removal from their dams will spend 200 to 250 days in feedlots, while backgrounded calves or yearlings will spend only 100 to 140 days in feedlots.

Although some animal rights literature leaves the impression that feedlot cattle are severely crowded, the fact is that feedlots are composed of many smaller pens containing cattle that are carefully managed and fed and that receive the best possible health care. Cattle usually are placed in pens with animals of similar age and size, reducing the possibility of animal conflicts due to size differences.

Typical feedlot pens hold only 75 to 200 cattle, regardless of the total number of cattle in the feedlot. Thus, even in large feedlots, each animal interacts with a limited number of other cattle. This allows for rapid adjustment to the feedlot

environment and minimizes the stress of animal-animal interactions. Feedlots are designed to provide adequate space for resting areas and to minimize animal-animal conflicts. Feedlots provide carefully balanced rations, shade, protection from cold winds, and intensive health care.

Beef cows and their calves are raised in the pastoral setting thought of by many consumers as the ideal lifestyle for animals. Beef cows, with few exceptions, are maintained on pastures or ranges and consume harvested forage during the winter when standing forage is not available. These beef cattle consume many feedstuffs that cannot be eaten by humans; if it were not for beef, many of these renewable forage resources would not be included in the food chain for humans. Much of the land that these cattle use for grazing cannot be used for food crop production. The beef cow/calf segment of the beef sector represents the ultimate in renewable resource utilization, and animals are free to roam on pastures and ranges.

Does Exhibiting Cattle at Fairs and Shows Place Animals Under Stress and Pain?

Pain is not imposed on cattle that are exhibited at livestock shows. These cattle have generally received special attention, and there is often a close human-animal bond. The stress that the human owners often experience when the animals are sent to market after an exhibition is evidence of the deep care and feelings for these show animals ([Hartsock and Gallagher 1990](#)). Even though the people who show these animals often regret the need to market the cattle, they benefit from these "lessons of life" -- that all humans and animals deserve the best of care while they are living, and that death is the ultimate end for all.

Do Research Studies Impose Undue Stress and Pain on Cattle?

Research studies in animal science departments and in colleges of veterinary medicine generally are designed to improve the nutrition, health, housing, management, genetics, and meat quality of cattle. In most of these studies, the cattle are handled much as they would be on a very well managed farm. The major differences are that the cattle are frequently in pens with fewer animals, feed is carefully weighed, and the animals are weighed about every 28 days. Most animal research protocols are reviewed by an animal care committee, and facilities are inspected to ensure that they meet animal care standards ([Curtis 1988](#); [Stricklin and Mench 1994](#)).

In some studies, blood samples are taken -- a routine procedure that also occurs on farms where blood samples are taken to test for diseases. Other studies may use animals that have cannulas surgically implanted to allow access to the rumen. Feed and fluids from the rumen are sampled to allow study of microbial populations and feed digestion. Cannulated cattle show no discomfort. Females have continued to reproduce and live long lives with the cannula in place.

HUMAN AND ENVIRONMENTAL ISSUES

Does Cattle Production Damage the Environment?

Although maintenance of high environmental quality is a concern of nearly everyone, cattle are not a primary cause of environmental degradation.

Soil erosion is a major concern of all who care about the future of food production. Most soil erosion occurs when farmers plant row crops on land that is too steep. This increases the exposure of soil to rainfall and the resulting washing of soil to lower areas -- often into streams. A proven method for preventing soil erosion is to maintain erodible land in forages, because forages provide good ground cover and hold the soil in place ([Brady 1990](#)). Therefore, planting erodible lands to forages and using these fragile soils for the production of ruminants (cattle and sheep) is a good way to maintain the soil for future generations.

Cattle have been blamed for the deterioration of water quality in the United States. In fact, industrial waste, human sewage, and runoff from urban and rural areas all are large contributors to surface water pollution. Agricultural sources of surface water and ground water pollution include chemical fertilizers, leaching of nutrients from plants, livestock manure, and herbicides and insecticides. Improperly managed livestock manure, in addition to commercial fertilizers,

can be a significant contributor of nutrients in surface and ground water. Producers must exercise care when spreading livestock manure on frozen soils. Excessive amounts of total nutrients, such as those contributed from livestock manure, should not be spread on land.

Cattle are sometimes blamed for the deforestation of tropical rain forests. In reality, the cutting of trees in these areas is fostered by the desire to obtain land for crop production and to meet the lumber demands of Asia. Cattle are frequently used to pasture the fields after the high-priced lumber is harvested.

Do Cattle Consume Large Amounts of Grain That Could Be Used by Humans?

Forages not used by people (such as pasture grasses, alfalfa, and corn stalks) and byproducts (such as distillers' grains, citrus pulp, and potato processing waste) form the vast majority of feeds consumed by beef cattle ([Bywater and Baldwin 1980](#); [CAST 1986](#)).

A beef cow consumes only forage for most of her life and may be provided with her only non-forage feed -- protein supplement -- for a short period during the winter when forage quality is low. Beef cows are not placed in feedlots, but are marketed directly from pasture or range when their productive life is completed.

The length of time that cattle spend in feedlots on high grain diets is variable. A calf typically starts life in March to May and remains with the cow on pasture or range until October or November. The calf may then be moved to a feedlot or may be maintained on a forage feeding program until a year later when it is moved to a feedlot as a yearling. Thus, beef cattle generally enter feedlots at weights of 450 to 650 pounds (calves), or 650 to 900 pounds (yearlings). For example, calves may enter the feedlot at 500 pounds and be marketed at about 1,100 pounds. Yearlings may enter the feedlot at 750 pounds and be marketed at about 1,200 pounds, while heavy yearlings enter at about 900 pounds and are marketed at about 1,200 pounds.

How much grain and protein supplement are required to produce a pound of retail beef?

- 1,200-pound beef cows marketed at 7 years of age have consumed a total of 840 pounds of protein supplement (120 pounds per year).
- 500-pound feedlot calves fed to 1,100 pounds consume 6.5 pounds of total feed (80 percent grain and protein supplement) per pound of gain.
- 750-pound feedlot yearlings fed to 1,200 pounds consume 7.2 pounds of total feed (90 percent grain and protein supplement) per pound of gain.
- Yield of retail beef per pound of live weight is .45 pound (.35 pound for cows).

Thus, it takes 2 pounds of grain and protein supplement to produce a pound of retail beef from beef cows and 3.6 pounds for heavy yearlings. For lighter weight yearlings and calves, the figures are 5.4 pounds and 6.3 pounds. These calculations do not consider the fertilizer value of the manure and urine provided by cattle during grazing and finishing.

Contrary to some published claims, it does not take 16 pounds of grain to produce a pound of beef ([Robbins 1987](#)). Since beef cows are a major source of ground beef, a value between 3 and 4 pounds of grain and protein supplement to produce a pound of ground beef would be appropriate. Only by assuming that beef animals are fed diets composed largely of grains from birth to market weight could a value as great as 16 pounds be obtained. Those familiar with the beef industry know that this does not occur. In fact, cattle do not require any grain for the production of meat; the microbes in the rumen manufacture high-quality protein from nonprotein nitrogen.

RESEARCH NEEDS

Although much of the concern about the welfare of beef cattle has been unfounded, the increased awareness on these issues has encouraged beef producers and livestock researchers to reexamine animal care and handling procedures. Improvements have been made: cattle are handled in a much better manner today than they were in the past. Continuing research on animal behavior, physiological indicators of well-being, methods to minimize stress, and interactions of

environment with health and productivity will help the industry further improve techniques for the care and handling of cattle.

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Animal Welfare Issues:

DAIRY

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INTRODUCTION

In 1980, the Humane Society of the United States ([HSUS](#)) developed a grading system of farm animal products for "conscientious omnivores." It categorized dairy products as acceptable, stating that "dairy cattle are the least intensively raised and confined of all farm animals" (49).

About 2 years later, M. Fox (36) of HSUS listed several concerns about the welfare of dairy animals. He cited the major issue as **"reduction of quality and quantity of individual attention"** in larger herds. The other welfare issues were:

- transportation of injured and sick animals to slaughter,
- dehorning of calves with caustic chemicals, with or without anesthetic,
- prolonged stanchion tying of cows, especially without exercise,
- need for separation of cow and calf,
- neglect of unwanted bull calves,
- raising replacements in individual hutches rather than in groups,
- confinement of veal calves in small crates (this issue is addressed in another discussion paper),
- the failure to employ welfare-related research knowledge, and
- production-related susceptibility to disease and metabolic disorders.

Similar concerns were expressed during a meeting of the Livestock Conservation Institute, reported by N. Black (17). (Castration was an additional concern).

Many animal rights activists and others have also identified the following issues or concerns:

- The separation of cow and calf at birth (24,45,46,81). "One of the saddest and most pathetic of farm practices . . . is the separation of the calf from the cow at birth or soon after (46)." The "dairy operator generally has no use for the newborn calf" (24).
- The cow is continually pregnant and carries large quantities of milk (calf suckles 20 times per day in nature) (24,45).
- Cows maintained in good health should be capable of living 15 to 25 years (24,71).
- Because drugs are a regular feed additive, they are used to maintain health, and antibiotics are substitutes for good management (38,46). The cow is "so tense, nervous, and hyperactive that she often has to be given tranquilizers" (71).
- Thousands of family farmers have been forced out of business by large factory farms, where cruelty is an integral part of animal management, in order to maximize 'efficiency' (36). (See also 24,45,47.)
- New technologies are detrimental to animal welfare. "'Supercows' may be forced to produce up to eighty calves a year through embryo transfer. Surrogate cows sometimes have difficult births as the implanted calf is larger than one she would naturally bear" (24). The overworked cow may be further stressed by daily injections of bovine somatotropin to increase milk yield (79,81).
- Environmental issues -- Methane gas production; odor; loss of nonrenewable resources; depletion of aquifers from raising crops to feed livestock (38,87).

DISCUSSION

The issues raised by M. Fox (36) provide a good framework for looking at current practices and alternatives in the dairy industry.

Reduction in the Quality and Quantity of Individual Attention

In 1979, there were about 11 million cows on 352,000 dairy farms, an average herd size of 30 cows (27). In 1989, there were 10.1 million cows on 205,000 dairy farms, an average of 49 cows per herd (90). Forty-six percent of U.S. cows were enrolled in a testing program, and the average size of these herds was 83 cows (60). In New York State, annual labor per cow decreased from 91 hours (h) in 1956 to 50h in 1978 (66). Milk yield per cow increased from 5,842 to 11,239 pounds (2,650 to 5,098 Kg) during this period in the United States. Cost of labor per cow averaged \$114 (or about 23h/cow) in Virginia DHI herds in 1989 (97). These trends were the result of increased mechanization, especially in forage and waste handling, improved milking parlor design, computerized rations and feeding systems, and continued genetic increase.

Management practices have not reduced the quality of cow care; for example, an evaluation of management on southern

dairy farms showed that milk yield per cow improved as farmers employed more of the recommended management factors (22). "A typical dairy farmer using all the management practices had a larger herd producing above the average, was younger than average, was in a farm partnership, and had a college education" (22). Herds with excellent mastitis control had larger milking parlors and greater efficiency (cows milked/man/hour) than herds with fair mastitis control (35). Mechanism and automation have allowed dairy producers to pay more attention to management practices such as teat dipping (pre- and post-milking) and dry cow therapy for mastitis control (effectively reducing mastitis to about 7 percent of quarters (63)).

Transportation of Injured and Sick Animals to Slaughter

Even though practically all dairy animals are transported sometime during their life (95 percent by truck (2)), relatively little legislation (Animal Transportation Act, 1906, 28-hour law (Public Law #340)) or research has addressed the effects of transportation. When Jersey bull calves were transported, they had greater heart rates when they were free to move about than when they were confined to wood crates (83). Beef heifers that were crowded during transit had heart rates that were 4 to 7 percent lower than heifers that were provided with ample space (30); however, carcass bruising increased with stocking density changes from low ($3\text{m}^2/\text{head}$) to high $1\text{m}^2/\text{head}$).

Additional physiological and behavioral studies involving calves indicate that transportation adversely affects welfare (86). Reducing time in transit, providing feed and water, avoiding extremes in weather, avoiding both weaning and vaccinating immediately before travel, avoiding exposure to unfamiliar animals, and same sex grouping during shipping should prevent or alleviate some stress (21). Injured or sick animals are particularly at risk in transit. An estimated 75 to 80 percent of the nonambulatory animals arriving at stockyards are large dairy animals. Nonambulatory cattle accounted for 0.1 percent of the cattle received at United Stockyards (S. St. Paul, Sioux Falls, Sioux City, Omaha, St. Joseph, Indianapolis, and Milwaukee) but these stockyards will no longer accept nonambulatory cattle (7).

Dehorning, Castration, Identification

Dehorning is a generally recommended practice that reduces injuries to both animals and handlers, bruising during transport, and aggressive behavior in grouped cattle (85). Use of a commercial electric iron for dehorning of calves under 30 days of age is the most popular method (15), and presents no long-term stress (55). Caustic potash works well on calves from 1 to 3 weeks old, but it must be applied carefully. A dehorning tube may be used on calves up to 45 days of age. Saws, dehorning clippers, and Barnes dehorners are commonly used to dehorn older cattle (31). Calves ages 7 to 16 weeks apparently did not benefit from a lidocaine block before dehorning (18). A veterinarian should anesthetize the base of the horn before dehorning adult animals. In one study, adult cattle (18 to 22-month-old heifers) dehorned using either electro-immobilization, a local anesthetic, or no anesthetic were compared to a control (non-dehorned) group. Serum cortisol levels rose significantly in dehorned heifers, but there were no significant differences by type of dehorning (23).

Castration is used to control aggression (39, 42), reduce injury, increase growth efficiency and increase market price at slaughter (19). The most common methods of castration are surgical (cutting about 1 cm away from the bottom of the scrotum, gripping the testicle, and removing it with a quick jerk), emasculator (the spermatic cord is severed without breaking the skin), and elastrator (applying a rubber band above testes, stopping blood flow to the testes) (16). Surgical castration causes less pain than the latter two methods (74). Breaking rather than cutting the cord during surgical castration causes the lumen to close and prevents bleeding. Calves are usually castrated when they are dehorned, i.e., before 45 days of age. Males exhibit fewer and less intense secondary sexual characteristics, including aggressive behavior, after they are castrated. Animal welfarists criticize the failure to administer anesthesia during castration, but as Friend (42) points out, "not using anesthetics for those relatively simple procedures greatly reduces the complications caused by the anesthetics," i.e., bloating and longer restraint with resulting stress. Injecting a lactic acid solution into the testes is an alternative method. In one experiment, 40 calves chemically castrated had less scrotal edema and gained more weight to 28 days, but weaning weight and 196-day weights were not different from surgically castrated calves (48). Cohen et al. (25) concluded that surgical castration caused greater stress than chemical castration. Over a 133-day period, there were no differences in the average daily gain of intact and castrated calves, but average daily gain of chemically castrated calves exceeded that of surgically castrated calves.

Dairy animals must be permanently identified for production, health, and registration records. Metal and plastic ear tags, tattoos, and hide brands are commonly used. Animal rights activists have strongly criticized use of hot hide face branding during the whole-herd buy-out program. Hot branding is a "prohibited operation" under provisions of the UK Welfare of Livestock Regulations (33). Freeze branding is less painful than hot branding and produces little hide damage, although it is visible at a distance (57, 59). Implanting a transponder just under the skin is the latest type of permanent identification. Destion/IDI markets more than 2.5 million transponders annually world-wide (5).

Prolonged Stanchion Tying of Cows, Especially Without Exercise

Stanchion or tie-stall housing protects cows from weather extremes, predators, and disease, lets dairymen provide more individual care, and is a location for milking. About 60 percent of dairy farms are located in the Great Lakes and Northeastern States, of which about 70 percent have stanchion barns (51). Stanchion and tie-stall barns made up 56 percent of U.S. dairy housing in 1958 (70); this proportion decreased to 29 percent by 1975 (51). The increasing popularity of the free stall, which was invented in 1960 (2), has contributed to the decline in stanchion housing. Free stalls save labor and bedding and are more suited to larger herds than tie stalls. Cows in free stalls may exercise at will. Most dairy operators turn cows out of stanchion barns one or more times daily for milking, to allow the cows to exercise, and to observe the animals for estrus (92). Cows in loose housing on deep litter rested longer than cows in free stalls or tie stalls, as did cows provided with a larger resting area, which also reduced aggression. Slatted floors in loose or free-stall housing may be used to conserve bedding and eliminate frequent manure handling. Urine and sloppy manure are immediately removed. Performance suffers, however, and cows can be injured if units are poorly designed (12,75,94). Waffle slats offer surer footing and stay cleaner (29). Cows in comfort stalls, which are longer and wider than tie stalls, spent more time lying (10.2h) than did cows in tie stalls (8.8h) (70). Dry cows and heifers spent 8.9 hours per day lying (11); lactating cows in free stalls spent 11.3 hours per day lying. Two-year old cows in tie stalls and mature cows in free stalls spent similar amounts of time lying (65). Cows need 10 to 12 hours of resting time in each 24 hours (94). A tie stall on wheels, the "Unicar," was an experimental housing, milking, and management system (20,71,81) that was never used in the United States and was used only experimentally in Europe.

Tail Docking

An emerging issue in the United States is the docking of cows' tails. The practice has been limited primarily to cows milked in rotary and parallel parlors to prevent disease, improve hygiene, and enhance ease of milking from the rear (50). The practice originated in New Zealand to keep dirty tails from impeding the milking process for pastured animals milked in rotary parlors (1). The general effects of this procedure on the cow's well-being and behavior need to be studied.

Pasturing

Pasturing would supposedly reduce stocking density, environmental pollution (waste disposal, undesirable odors), and energy costs, and would permit housing to be used for shorter periods (87). Many dairy managers continue to pasture dry cows and heifers, but the trend is toward dry-lot management of the milking herd. Rollin (72) noted that legislation in Sweden that granted cattle the right to graze indicates that "U.S. society will soon demand that agriculture back off, at least to some extent, from confinement and pay greater attention to agricultural animal comfort and happiness."

Pasturing has its problems, however, and may not be as ideal as animal rights activists perceive. Weather limits the grazing season (150 days or less) in several Northern States. Pasture will not supply the nutrients needed to maintain high milk yield, because it is difficult to provide forage of uniform quality and quantity. Shade and water, heat, insects, susceptibility to bloat, energy expended in grazing and travel to the milking parlor, and toxicity from soil are other considerations associated with pasturing. For example, high-producing cows spent much less time lying down and significantly more time grazing at all stages of the grazing season (10).

Separation of Cow and Calf

Calves have little circulating antibody at birth and need colostrum to provide passive immunity (67). There is no consensus on how to provide colostrum: the calf can nurse the cow for 4 days (31); after initial nursing or hand-feeding, the cow and calf can be separated within 24 to 48 hours and colostrum can be bucket-fed (15); the calf can be moved at birth (or when dry in winter) to a calf hutch (4). At 12 to 24 hours after birth, blood immunoglobulin levels tended to be higher in calves fed colostrum 1 to 2 hours after birth than in those fed colostrum 6 or 12 hours after birth. "There was no meaningful relation between calf mortality and the time cow and calf remained together ($r = -.14$, $n = 106$)" (34). An account of Camargue cows, a breed found in southern France, indicates that a cow leaves the herd to give birth, hides the calf for the first 3 to 4 days, and returns only to nurse it for short periods. Calves then join a subgroup of young animals, which tend to play and sleep together. Nursing appears to be a community activity, as most dams nurse their calves about the same time. Calves travel together when the herd moves (26). A cow and her calf usually bond shortly after birth; however, it is not unusual for cows to accept nursing by several calves (43). Suckled Friesians weaned at 7 months and transported to new housing required longer to habituate to the new environment than did artificially reared Friesians (4 vs 2 days). However, previous rearing did not appear to have any long-term effects on behavior (91).

Neglect of "Unwanted" Bull Calves

Newly born bull calves a few days old are generally transported to slaughter, to auction, or to ranches specializing in rearing dairy beef or veal. Holstein bull calves are becoming popular feedlot animals. One broker handles 45,000 per year and raises an additional 5,000 female dairy calves (82). Dairy operators may turn rearing of male and female calves to specialists due to limitations in labor, land, and facilities. Recommended care for surplus calves includes the following:

- provide colostrum and adequate feed soon after birth,
- house in well-drained, sunny, sheltered, outdoor pens free of hazards or in clean, dry, indoor pens,
- avoid overcrowding,
- use clean, sterile feeding utensils,
- market only healthy calves that are at least 5 days old,
- transport calves in clean vehicles and protect them from wind, heat, or cold during transport (which is more stressful than castration or dehorning),
- avoid overcrowding and physical abuse by handlers,
- drive to avoid injury, stop at 2-hour intervals to check calves, and do not travel continuously more than 20 hours (44,54,74).

Housing

Diseases are easier to control and intersucking can be avoided when calves are raised individually. Outdoor hutches are becoming increasingly popular because it is difficult to properly regulate air and humidity in enclosed housing (4). However, calves are reared in warm, enclosed barns; cold, enclosed barns; open-front barns; various types of hutches; and on nurse cows (4,15,31,67,74). Individual pens (either in enclosed or open housing) were the most common method of rearing calves (53 percent), and group pens were the least common method (12 percent); some dairies combine both types of rearing (calves were kept inside for a few weeks and then moved to outside hutches (35 percent).

Calf losses were substantially higher in herds where calves were reared in enclosed housing (95). Calves reared in groups consumed solid feeds at an earlier age and had higher average daily gains (ADG's) than calves raised individually (93). However, in a study involving six pairs of monozygous twin heifers, feed intake and ADG to weaning did not differ when one twin heifer was reared in a group and the other was raised in a hutch (69). Physiological data indicated a decreasing gradation of stress to calves raised in individual stalls, individual pens, hutches, and group housing (40). Calves in individual stalls and pens were on wooden slats, however, while hutch and group calves were on a dirt base. Rearing calves with nurse cows is a more common practice in beef production. The number of calves must be adjusted to the milk yield of the cow. The cow usually must be restrained before it will accept nursing by strange calves. Proponents of the system claim it offers labor savings and a lower incidence of digestive upsets and bacterial infections (74).

Failure To Use Welfare-Related Research Knowledge

In the opinion of the HSUS's Fox, "the welfare of dairy cows, especially in small and medium-sized, owner-operated herds, is generally far superior to that of other farm and animal species" (36). Research studies on welfare-related topics "reflect the close correlation between welfare and maximizing individual productivity" (36). The 1988 "Guidelines for Dairy Cattle Husbandry" (3) were based on current practices and research data. The guidelines also illustrate the diversity of management facilities and practices. While it may be feasible to immediately adopt improved animal-related practices, changing the cow's physical environment according to all the latest research recommendations may not be feasible. Economics dictate that most capital facilities be depreciated over several years.

Production-related Susceptibility to Disease and Metabolic Disorders

The average cow in the United States today produces about six times more milk than the average cow did at the turn of the century (6,655 vs. 1,136 kg) (58,88). Cows in some herds produce more than 11,000 kg of milk. Worldwide, milk per cow continues to increase about 1.25 percent yearly, which may make future cows even more susceptible to metabolic disorders (58). However, this increase was possible only through improved genetics, artificial breeding, nutrition, disease control, and management. The ratio of milk cows to human population in the United States has decreased from 1:5.6 (1940) to about 1:27 today. There is no evidence that the genetic increase has plateaued (individual cows have produced more than 63,000 pounds (28,600 kg) of milk. To remain competitive in a free-market economy, dairy managers will continue to rely on genetic improvements, least-cost balanced rations, disease control, and improved cow comfort.

Ketosis, one of the most important metabolic diseases of high-producing cows, has an incidence of about 4 percent (58). It may be induced by a prolonged energy deficit plus an influx of the precursor of ketosis, and may be reversed by effective treatment (62). Preventive measures include use of rations that prevent cows from becoming excessively fat before they calve and feeding of concentrate with adequate amounts of high-quality forage after calving. Measures to prevent ketosis should also reduce the incidence of displaced abomasum, which is apparently caused when dry cows or cows in early lactation are fed excessive concentrates and insufficient dietary fiber. Proper rations can also help prevent milk fever, a disease whose incidence increases at the fifth or sixth lactation. Feeding a diet low in calcium at least 5 days before calving stimulates the parathyroid in preparation for the increased needs for parathyroid hormone and 1,25-(OH)₂D after calving (58).

CONCERNS EXPRESSED BY ANIMAL RIGHTS ACTIVISTS

Separation of Cow and Calf at Birth

The need to separate dam and young at birth has been noted, but activists' description of both animals as being in a state of "anguish" (46) or anxiety is not universally accepted (73). Separation soon after birth is common in cattle, an "outlying species". Before grazing, cattle mothers, given the opportunity, "hide" their young for up to several hours at a time. Maternal instincts have not been a focus of selection in dairy cattle, because of the emphasis on milk production; consequently, bonding between dam and young may not be as strong as in beef cattle or other species. Emotional upset may be lessened by early separation, before bonding has occurred. Intimate human contact during the critical period improves ease of handling and milking temperament (26).

For 305 days, an average dairy cow produces at least six times as much milk as a calf needs daily. Artificially reared dairy calves are usually weaned by 70 days. A calf allowed to ingest excess milk is likely to experience diarrhea and death.

Cow Pregnant Continually

Some activists object to the fact that nearly continuously pregnant cows are constantly burdened with carrying large quantities of milk. Most dairy operators strive for a calving interval of 2 months, but this goal is rarely achieved.

Estimated economic losses due to excessive days open (more than 90 days) are \$1.22 per day (56). Inducing lactation using hormone treatment has been about 70 percent successful, but lactation yields were only 70 percent or less than that achieved in previous years (32). The induction of ovulation has been associated with side effects such as abnormal estrous behavior, reduced fertility, cystic follicles and corpora lutea, and chronic vaginal prolapse. Treatment with estrogen reduced abnormal estrous behavior, but milk yields were only 20 percent of normal (78).

An average cow carries 5 lbs. (11 kg) of milk in her udder at milking time if milked twice daily. This is about 1.6 percent of her body weight (equivalent to about 2 pounds for a 120-pound human). Cows in many high-producing herds are now milked 3 or 4 times daily, leaving less milk in the udder than twice-daily milking. Cows spend about half the day lying down, which relieves strain on muscles and ligaments that support the udder weight. Beef calves suckle only about 5 times per day (43,54).

Longevity

Few cows live to be 15 years of age. A 27-year-old Holstein cow in Wisconsin generated considerable publicity when she died, after giving birth to 22 calves in her lifetime (13).

Records of nearly 300,000 Holstein (the predominant U.S. breed) from 1966 to 1986 indicated that average herd life was 3.4 lactations (64), which means cows leave the herd at about 6 years of age. The average age reported in Wisconsin Holstein herds was 5 years (76). Herd life was positively correlated with production during the first lactation. More than 56 percent of cows culled in the first lactation were culled because of low production (28). Nutrition affects the expression of genetic potential, age at puberty, breeding age, and calving age and is the most important environmental factor influencing life-span within the herd (31). Lower production, slower increases in herd size, shorter first calving intervals, and longer subsequent calving intervals explained 70 percent of the variation in the average age of a herd (76). All of these factors except shorter first calving intervals would tend to lower income. Reducing incidence of disease (including mastitis), injury, and reproductive problems would contribute to an opportunity to increase average herd age.

Use of Drugs to Maintain Health, and Antibiotics as a Regular Feed Additive

Antibiotics are commonly used in calf feeds until the calf is about 4 months old to improve growth, reduce the incidence of scours, and improve appetite (15,31). Feeding antibiotics to adult cows is not recommended (31). Antibiotics have greatly reduced the incidence of contagious diseases of cattle, some of which endangered human health (53). Antibiotics have been used for more than 30 years to prevent and treat mastitis, but care must be taken to avoid residues in milk or meat. In 1990, the Milk Industry Foundation tested more than 2 million tankers and detected drug residues in only 0.1 percent of them. Delegates at the 23rd National Conference on Interstate Milk Shipment (April 1991) adopted strict measures to ensure that no antibiotic residues enter the milk supply. Every load of Grade A milk is screened. If residues are detected, the milk is discarded and violators are not allowed to ship milk for 2 days (or if a second offense, 4 days). If there are three violations in a year, the regulatory agency may revoke the violator's Grade A permit (77). Tranquilizers are not used, as some critics allege, nor are hormones implanted to promote milk production.

Family Farms Being Forced Out

Large farms (those having \$250,000 or more in gross sales in 1990) represent less than 5 percent of U.S. farms. The average farm was 429 acres in 1978 and 461 acres 12 years later -- an increase of less than 3 acres per farm per year. There were 170,000 fewer farms in 1987 than in 1978, but 88.5 percent were fully or partly owner operated -- an increase of .8 percent from 1978 to 1987 (89).

Detrimental New or Prospective Technology

Superovulation and embryo transfer of genetically superior donor cows can significantly improve reproductive rates. The total number of possible ova a cow may ovulate in her lifetime is 21,000 (15). Embryos resulting from repeated superovulation can be split and frozen for future use. In one study, only 43 superovulated donors yielded transferable

embryos (6.2/donor) (9). The number of transferable embryos ranged from 5.3 with the first flush to 2.2 on the fifth flush (14). Cows have been superovulated eight times at 50-day intervals and still responded to superovulation (80). There may be a viable alternative to superovulation involving the puncturing of bovine follicles during transvaginal ultrasound scanning, retrieval of oocytes by aspiration, and in vitro maturation and fertilization of oocytes prior to transfer. The procedure does not interfere with the cow's normal reproductive cycle. It is estimated that 30 transferable embryos could be obtained from the 135 oocytes available per animal in a year (68). Embryos are transferred to recipient cows, usually by nonsurgical techniques similar to those used for artificial insemination (80). There is no evidence that embryo transfer increases the incidence of difficult births. Several factors are associated with difficult births, including those associated with the calf (size, sex, multiple births, malpresentations, and stillbirth) and the dam (body weight and size, pelvic area, and age or parity of dam) (84). The heritability of birth weight (about .45) indicates more than half the variation is due to nongenetic influences. The calving ease scores of bulls used in AI enable breeders to select for that trait.

Bovine somatotropin (BST) has recently been approved by FDA, but is not at this time extensively used in the dairy industry.

Environmental Issues

It is estimated that cattle produce about 1.8 percent of the methane in the upper layer of the atmosphere (61). Cows lose about 6 percent of their energy as methane. Losses are about 2 percent for cattle on high-concentrate diets and as much as 12 percent for cattle on all-forage diets. Covering of manure lagoons to trap methane (and control odor) could yield useable energy and substantially reduce methane emissions from livestock. The use of BST would mean that 11 percent fewer cows would be required for the current level of milk production. In turn, this would reduce inputs (feed, 9 percent; nitrogen and phosphorus, 10 percent; cropland, 6 percent; irrigation water, 9 percent; fossil fuel, 12 percent), waste products (urine, 5 percent; manure, 8 percent; methane, 8 percent), and soil loss (5 percent) (52).

Pollution of air, water, and soil has been a concern, especially for larger dairies, since the early 1970's. Registration of facilities and a permit to operate, depending on size of operation (more than 700 mature dairy cows), are required by the U.S. Environmental Protection Agency (EPA) and various State counterparts. These help to ensure that dairy wastes are properly handled (31).

A return to "green pastures" (38) might distribute animal waste more evenly, but more land and cattle would be required to produce the 148 billion pounds of milk currently consumed in the United States. In New Zealand (NZ), where almost all cows graze pastures, average milk production is 3,346 kg milk/cow vs. 6,461 kg in the United States. (89). Milk production by AI daughters of U.S. and N.Z. bulls was almost equal when they were milked in a common environment (4,174 vs. 4,015 kg milk and 163 vs. 161 kg fat for U.S. and N.Z. respectively in Polish tests (41)). Public attitudes are the major obstacle to utilization of waste. Animal waste may be used as fertilizer, bedding material, feed supplement, and (as biogas) for energy production.

Ensiled, dehydrated, or mechanically (aerobically) digested manure is no longer an air pollutant and has a chemical composition similar to that of the original feed. Waste from other species can be used as a high-quality ingredient in dairy rations (8).

Some animal rights activists advocate restricting animal or human populations to a size that will enable them to be fed strictly from plant source foods (47, 96). An official with the American Medical Association noted that it would be difficult to receive the minerals, vitamins, and other nutrients recommended by the National Academy of Sciences without regular consumption of meat and dairy products (6). Cropland represented about 18 percent of U.S. acreage in 1987. Pasture, including 3 percent cropland used for pasture, was 29 percent; forest land, which includes some land devoted to livestock grazing acreage, was another 29 percent (89). Ruminants (including dairy cattle) convert to human food much of the plant material on these pastures and forest lands, a resource that otherwise would be wasted. Cattle also consume many byproducts, such as cottonseed hulls, cull fruits and vegetables, brewery waste, etc., that would otherwise be discarded.

OUTCOME

Dairy farm numbers will continue to decrease, as will man hours per cwt. of milk produced. Average herd size, milk yield per cow, and use of free stalls and/or dry lots will continue to increase. The industry will continue to meet animal welfare guidelines that now govern the use of dairy teaching and research animals (3). The animal rights/welfare movement will probably become more influential, and dairy producers should be aware of their legitimate concerns about animal welfare. New technologies will let dairy managers observe animals more closely and thereby improve management. New technology will also help researchers measure and evaluate animal stress, information that will be useful in developing computer models of the stress associated with various production practices. Drug and antibiotic residue in meat and milk will be regulated more carefully, and standards of milk quality will increase. Methods will be found to reduce pollution associated with intensive dairy farming practices. These improvements are unlikely to persuade the animal rights activists that animal agriculture should not be eliminated. Nonetheless, explaining to consumers the reasons underlying the practices employed on dairy farms and the benefits that accrue from dairy products will certainly enhance the credibility of the dairy industry.

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Animal Welfare Issues:

EQUINE PRODUCTION AND PERFORMANCE

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INTRODUCTION

Those concerned with horse welfare have raised the following issues:

Performance Horses

Can painful techniques to improve the performance of show horses be eliminated? "Soring," for example, is a procedure used on Tennessee Walkers to encourage exaggerated lifting of the front legs. Soring consists of abrading the skin of the limb and applying irritants. Another practice is severing of the tail tendon or using alcohol injections to prevent tail movement of quarter horses to make them appear more calm (excited horses may lash their tails or carry them high). There is also some concern about whether techniques such as tight straps around the flanks are used to encourage bucking in horses used for bucking contests in rodeos ([1](#)).

Is sensory deprivation used to improve performance? Some saddlebred and Arabian show horses are kept isolated in darkened and sound-dampened stalls except when in the show ring which, in contrast, is brightly illuminated and noisy. The contrast may result in a hyperactive behavior that the judges might misinterpret as a naturally alert or spirited

temperament.

Can injury to race horses and cross-country jumping horses be reduced? The public is aware of breakdowns on the race track and wonder if the horses were fit to race (2,3) or if the track was suitable. Three-day event competitions at the international levels have been associated with difficult courses that result in injuries and accidents to horses. These incidents may be viewed by many people, because an accident makes a more exciting presentation than a flawless, but safe, performance.

Killing of Horses

Are horses slaughtered or euthanized humanely? Euthanasia of race horses has been criticized as inhumane when a paralytic agent is used. As has been the case for cattle and other food-producing animals, the sale of horses for meat has resulted in thefts and in problems during transport and handling.

Feral Horses

Are the feral (wild) horses of the United States properly handled by the Government? Abuses in the Adopt-a-Horse program have generated considerable publicity. Some people acquired large numbers of horses for eventual resale and did not provide proper care for them. There has also been concern about stress on the horses during capture and transport, and about horses who are moved from their home range and are then unable to procure enough food and water in the new area or to find their way back to the original range(4).

Identification

Is branding painful? Some horses are branded with hot irons and others with freeze brands.

Management and Use

Are horses properly housed and fed? The horse evolved to live in a herd and to eat a high-roughage diet of grass. What are its requirements when it is confined and fed a high grain and/or protein diet?

Carriage Horses

Is the use of carriage horses in the city cruel? Questions have been raised about whether carriage horses are worked for excessive periods and/or in extreme temperatures (5).

Estrogen Production

Are lack of freedom to move and water access detrimental to mares? The urine of pregnant mares is used as a source of estrogen for post-menopausal women. The mares are kept in straight stalls wearing a urine collection harness for six months with limited opportunity to exercise. Water is limited to increase estrogen concentration in the urine.

DISCUSSION

Performance Horses

Soring is prohibited by USDA regulations, but occasional problems may arise when funds are not available to check for infractions. Shoe size and weight are also regulated (6).

The American Quarter Horse Association prohibits the practice of **altering tails** (7). An electromyographic technique has been developed to determine whether a horse's tail has been denervated. Consideration might also be given to other

tail issues. American saddlebreds and other gaited horses may have the tail tendon cut and the tail placed vertically upright in a harness. The harness or tail "set" is worn most of the time and restricts swishing of the tail. The tails of other breeds, such as Hackneys and many draft breeds, are docked, i.e., the bottom portion of the tail is surgically removed to shorten it and prevent interference with harnesses. The horses cannot defend themselves from insects and so extra care must be taken by use of insect control, screens, and repellents.

The degree of discomfort that rodeo horses may experience from such practices as the use of **tight flank straps** has not been determined.

Some research has been done on **sensory deprivation**. The advisability of housing horses in the dark is not supported by a study that showed that horses prefer a lightened environment and will work to obtain light (8).

Extensive measures are taken to prevent **injury to race horses and jumpers**. Veterinarians and officials examine horses before they race and make every effort to prevent lame or otherwise unfit horses from racing (9). This includes pre-race examination of each horse in motion; examination of any areas of the horse that appear abnormal; and observation of the horse during the parade to post, at the starting gate, and during and after the race. Horses can be denied entry into a race for health reasons. In addition, no stimulant, depressant, narcotic tranquilizer, or local anesthetic is to be used on the horses. One drug, the anti-inflammatory medication phenylbutazone, may be administered intravenously 24 hours before the race. The only other medication allowed in most States, but not in New York, is furosemide, a diuretic that may be given to horses diagnosed as having exercise-induced pulmonary hemorrhage.

Race horses have a high rate of injury. One third of those brought to tracks for racing leave because of musculoskeletal problems (10). Although injuries are to be expected in any athletic endeavor, the factors that predispose horses to injury, such as type of track, weather conditions, and age of the horse, are being investigated (11). Older horses and ones that have raced within 12 days may be at greater risk of breakdown, i.e., severe injury resulting in euthanasia, retirement, or prolonged recovery time.

Killing

Slaughter of horses is usually preceded by stunning with a captive bolt device or electricity. If the procedure is done properly, the horse will be unconscious. Conditions during transport of horses to the slaughter house may be inhumane; crowding and injury can occur when too many horses are loaded on cattle-type trucks with a ceiling that is too low.

The American Veterinary Medical Association forbids the use of paralytic agents such as succinylcholine for euthanasia (12). Only if a horse is a danger to itself and its handlers can succinylcholine be used to immobilize the horse, but an anesthetic such as sodium pentobarbital must be administered immediately to euthanize the horse. If a paralytic agent alone is used, the horse will suffocate, but be fully conscious -- an inhumane death.

Feral Horses

Feral animals are derived from domestic rather than wild animals. All the free-ranging horses in the United States are feral and are the descendants of escaped or abandoned horses. The horses compete to some extent with the truly wild native animals and to a greater extent with cattle. The Federal Government's management program for feral horses is designed to preserve the animals, but prevent overpopulation, which would result in starvation and environmental damage. The horses are rounded up by the Bureau of Land Management (BLM) and sold through the Adopt-a-Horse program. Because adopters cannot sell the animals for 1 year, purchase of the horses for slaughter is discouraged. Furthermore, checks are made by the BLM so that horses treated inhumanely can be reclaimed. Those reclaimed have amounted to less than 1 percent of all adopted horses (13). Some of the problems that have developed, such as what to do with unadoptable horses, are discussed in a study by the Government Accounting Office (14).

Identification

Any procedure that damages tissue is painful. In cattle, hot branding produces an escape reaction and a greater activation of the sympathetic nervous system than freeze branding, but both procedures cause an increase in cortisol (15 and 16). This is probably true in horses as well. Less painful permanent identification, such as implantation of a silicon chip, hold promise, and may lead to the elimination of breed requirements for branding.

Management and Use

Environmental extremes may influence the welfare of a horse. Horses can withstand dry, cold temperatures, but will become chilled when wet and cold. Therefore, it is important that horses have access to a dry environment (17). When temperatures are high, shade will reduce heat stress. Access to water and salt will allow the horse to replenish moisture and minerals lost in sweat, the primary means of thermoregulation in horses in hot climates. Horses deprived of salt will exhibit a depraved or depressed appetite.

Horses given free access to feed will eat for 10 to 12 hours per day (18). If fed primary concentrate diets (high grain, low roughage) that meet all their nutritional needs in 1 or 2 meals, horses may develop behavioral abnormalities such as wood chewing, tail biting or coprophagy (eating of feces), and psychogenic (nervous) salt eating. Ideally, at least 50 percent of the total ration should be in the form of forage. However, horses can adapt to a wide variety of diets, as long as all changes are done slowly over the course of 2 to 5 days (depending on the magnitude of the change) (19). Changes in diet, even from grass hay to alfalfa hay or pasture should be done slowly to avoid colic (abdominal pain) and the hoof disease, founder.

Drinking water is essential for all animals, including horses. Free-choice access to clean water is preferable. If water intake is limited, the average 1,000-pound horse should be provided no less than 10 gallons of water per day. Hot environmental temperatures, lactation, or hard work will increase the water requirement. Horses cannot obtain sufficient water from snow or ice.

Being kept in a stall limits socialization between horses. Size of stall may inhibit physical movement or sleep patterns. The two kinds of sleep are slow wave sleep and rapid eye movement (REM) sleep. Although a horse can enter slow wave sleep while standing, it must lie down for REM sleep (20). Therefore, a horse should have enough room to lie down, preferably on its side. The stall should be as wide as the horse is tall. If the horse is tied, the tether should be long enough to permit the animal to lie down. The recommendations for horses are 9 ft²/100 lb body weight for a box stall or 12 x 12 ft and 4 ft²/100 lb for a straight stall or approximately 5 X 9 feet (17). Horses prefer to lie on soft surfaces, so bedding such as straw or shavings may be necessary. Horses are reluctant to lie on wet surfaces, particularly in cold weather, so dry surfaces should be provided.

In many southern and tropical climates, horses are tethered by the halter (or by the leg, which is less safe) on a long rope to a stake in the ground or a post. All of the same requirements for feed, water, shelter in adverse conditions, salt and exercise apply to tethered horses. The tether line needs to swivel on the stake to avoid tangling and allow free movement. The rope must be thicker than 2.2 cm (1 inch), and the horse must be trained to prevent struggling with the rope. Thinner ropes can cause rope burns on the legs.

Exercise at gaits faster than the walk is probably not critical, as free-ranging horses spend little time trotting or cantering. Horses on pasture spend 70 percent of daylight hours grazing (21). Grazing usually involves walking a step, prehending grass, chewing several times, prehending again, chewing, walking a step or two, etc. In other words, the horse is walking, but walking very slowly for most of the 24-hour period. Horses that are confined in stalls, especially straight stalls may require more space for adequate movement. These horses may exhibit edema of the lower legs as a result of inactivity. Access to a paddock or hand walking for at least 15 minutes per day would probably eliminate these problems (17).

Horses roll in order to groom or scratch the parts of their body they cannot reach with their teeth or hooves. Some horses will roll in their stalls, but most will not. Horses housed in stalls will often roll when provided with a larger space. Horses that do attempt to roll in their stalls may injure themselves if they are unable to rise.

The development of stereotypies, such as weaving (walking in place, shifting weight from side to side), and stall-

walking (continually walks a circle or a figure 8 in the stall) may occur because of a lack of adequate opportunity to socialize, exercise, and/or engage in other species-typical behaviors (22). It is notable that these "stable vices," which are common in domestic horses, have not been reported in any of numerous studies on feral horses (23). The presence of a large number of stereotypies in a large number of horses may be a manifestation of improper management.

Neglect cases are usually instances in which the horses are deprived of feed, water, or medical attention or kept in dirty enclosures. Abuse is the active participation in the physical maltreatment of the horse; cruelty includes an element of psychological mistreatment leading to suffering. Severe training methods could involve abuse or cruelty. Neglect, cruelty, and abuse are regulated by national, State, and local laws.

Carriage Horses

The use of horses to pull carriages in cities is controversial. The specific welfare issues include (1) housing of the horses, (2) length of workday, and (3) temperatures to which they are exposed. Many cities have legislation that restricts the hours and temperatures at which carriage rides can be made. Those concerned about the horses should learn what the laws concerning carriage horses are in their locality. They should also find out which official or government agency determines whether the horses are properly housed.

RESEARCH

Traditionally, equine research has focused on nutrition and on diseases affecting horses. However, some research has examined stressful situations in horses, including racing, isolation (24), trailering, and confinement (25,26). Other studies have shown that horses prefer bedding (27), light, and at least some contact with other horses (8).

Future research into the welfare of the domesticated or feral horse may examine behavior patterns of domesticated horses, stressful situations, alternative training methods, housing, transportation, use of drugs, and enhancing the health of individual horses.

OUTCOME

Regulations concerning carriage horses may restrict or eliminate their use within city limits. These restrictions may increase costs to the consumers. If carriage horses are banned, business and employment opportunities may be unjustly lost along with the opportunity of the public to interact with horses. Banning of horse racing, rodeos, or horse shows would have even more profound effects on the horse industry.

More inspection of mares used for estrogen production and removal of restrictions on the amount of urine a farmer can submit, thus eliminating the need for a concentrated urine have been instituted and should reduce the stress on the mares.

The USDA, American Horse Show Association, and specific breed organizations have rules and regulations that prohibit practices deemed to be cruel. Public pressure may result in more rules and stricter enforcement. The goal should be to improve horse welfare without restricting the ability of the public to enjoy interaction with horses.

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Animal Welfare Issues:

FUR FARMING

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INTRODUCTION

Two primary issues dominate discussion of animal welfare on fur farms. The first issue -- confinement -- is not unique to fur farming. Animal rightists contend that mink, despite more than a century of domestication, remain essentially "wild" animals and therefore should not be confined in pens.

The second issue is euthanasia. Animal rightists contend that furbearing animals are harvested using inhumane methods such as electrocution or cervical dislocation.

DISCUSSION

Through its national association, the Fur Farm Animal Welfare Coalition, the fur farming industry has established a program of humane care guidelines to encourage proper animal welfare practices. The guidelines were developed in consultation with veterinarians, animal scientists, and other experts. Specific topics addressed in the guidelines include farm management, physical accommodations (site, sheds, pens, nest boxes), food and water (nutrition, feed preparation, feed distribution, watering systems), health and disease control, environmental quality (sanitation, water quality), transportation of live mink, and euthanasia.

Industry Certification Program

Under the coalition's merit award certification program, fur farms meeting all industry standards are certified after inspection by an independent veterinarian to verify compliance with industry standards. Farms must be reinspected and recertified every 3 years. About 95 percent of domestic mink production takes place on certified farms that meet industry standards and have passed veterinary inspection.

Euthanasia

Industry guidelines with respect to euthanasia follow the recommendations of the 1986 American Veterinary Medical Association (AVMA) Panel on Euthanasia. The guidelines prescribe the use of carbon monoxide or carbon dioxide bottled gas for mink and lethal injection (pentobarbital sodium or secobarbital/dibucaine) for fox. The AVMA has recommended these methods as more humane and more aesthetically acceptable than most alternatives.

Compliance with industry standards is lower for fox farms than for mink farms because the recommended lethal substances for euthanasia are difficult to obtain. Federal drug regulations require that such substances be used under the supervision of veterinarians or other personnel registered with the U.S. Drug Enforcement Agency. Since the services of such authorized personnel are frequently unavailable or too costly for fox farmers, some have found it difficult to comply with this standard. In such cases, the Fur Farm Animal Welfare Coalition's guidelines require that producers employ an alternative method considered humane by the inspecting veterinarian.

Although compliance with industry standards among mink farmers is high, it is not 100 percent. A small number of mink farmers continue to use euthanasia methods other than those recommended in industry guidelines. A handful of mink farmers use cervical dislocation because they believe the use of carbon monoxide or carbon dioxide results in discoloration of the pelts. The AVMA cites as advantages of cervical dislocation that it: (1) will induce immediate unconsciousness, (2) does not chemically contaminate tissues, and (3) is rapidly accomplished. Its disadvantages, according to the AVMA, are that it may be aesthetically displeasing and that its use is limited to poultry, mice, immature rats and rabbits, and other animals weighing less than 1 kilogram. The method is not generally recommended for heavier animals. In cases where it is considered acceptable, its use is contingent upon the proper training of personnel.

Fox farmers who are not able to utilize lethal injection most commonly use two alternative methods -- carbon monoxide or carbon dioxide gas, or electrocution. The AVMA recognizes the use of gas for "small dogs" as rapid and painless, and without stress to the animal, when properly administered. The AVMA recognizes electrocution as humane if

current is directed through the brain and advises against methods that direct current through the heart. Disadvantages of electrocution, according to the AVMA, are that it is hazardous to personnel, time-consuming per animal, difficult with vicious or intractable animals, and considered "aesthetically objectionable."

Public concerns focus largely on the matter of euthanasia; when people are informed of the humane practices utilized on the vast majority of fur farms, they generally indicate acceptance of farm-raised fur.

Research

The fur industry has conducted extensive research on public attitudes toward the use of fur. This research indicates that most fur users have relatively high comfort levels with the farm-raised product when information is provided about humane care methods.

Media spokespersons for the Fur Farm Animal Welfare Coalition confirm that in numerous radio and television interviews, many of which have allowed for viewer/listener questions and input, public acceptance of farm-raised fur has remained relatively stable.

Independent research appears to support the continued use of the current practices outlined in the Fur Farm Animal Welfare Coalition's merit award guidelines. The fur farming industry has actively maintained a program to educate producers and encourage compliance with industry standards. While continued research may result in new knowledge leading to changes in industry practices, today's practices are solidly based on accepted principles of veterinary medicine and the technical knowledge of recognized experts in furbearer science.

Outcome

Animal welfare groups are attempting to reform specific aspects of domestic fur production; the more radical animal rights activists seek to eliminate all human use of animals. Because many members of the public reject the no-animal-use view, animal rights initiatives often hide behind the more acceptable "animal welfare" issues.

To the extent that animal rights activists are successful in their ultimate goal of eliminating all animal use, there will be negative effects for producers, consumers, and animals alike:

- The cost of compliance with unrealistic and unnecessary government regulations will force **producers** out of business.
- Increased government regulation of agriculture will mean, over the short term, higher prices for the animal products that **consumers** enjoy. Over the long-term, consumers will lose the right to choose animal products at all, resulting in greater reliance on synthetic substitutes. This is particularly true for consumers of fur, since most alternatives to natural fur are petroleum-based synthetics.
- These changes may ultimately mean that some species of **animals** will become endangered or even extinct. As human civilization expands, the availability of natural habitat for animals diminishes. If natural habitats cannot absorb these animals and support them, the long-term survival of many species will be at risk.

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Animal Welfare Issues:

HANDLING OF CRIPPLED AND NONAMBULATORY LIVESTOCK

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INTRODUCTION

Livestock handling practices have improved over the past several years. For example, a survey by Grandin ([1990](#)) indicated that during the last 15 years, the incidence of rough handling at feedlots and packing plants has decreased. Unfortunately, handling of "downer" and crippled nonambulatory livestock still needs improvement. Although there is an economic incentive to handle most livestock in a humane manner, no such incentive exists for nonambulatory animals. Crippled animals that are unable to walk represent a very small percentage of the total livestock handled, but these animals often suffer greatly.

DISCUSSION

Crippled Downer Cattle

From a humane standpoint, crippled nonambulatory cattle on the farm and at livestock markets are a serious problem. Their large size sometimes makes moving them in a humane manner almost impossible. The emphasis should be on **preventing** downers and cripples. A high percentage of crippled, downed cattle are old dairy cows, which often are very emaciated and weak; few have broken legs. Many of these dairy cows could have been prevented from becoming downers if they had been transported to market or slaughter before becoming too weak to walk. The nationwide [NonFed Beef Quality Audit](#) conducted in 21 cow and bull slaughter plants indicated that 0.9 percent of the cull beef cows and 1.3 percent of cull dairy cows were disabled and unable to walk. Severely lame cattle were 3.4 percent of the beef cows and 5.8 percent of the dairy cattle. These animals were all in poor condition before they left the farm.

About 5 percent of dairies are responsible for 95 percent of this problem. These dairies should be identified and should receive the training necessary for improved handling procedures. In 1985, [Grandin](#) surveyed 51 auction markets and observed downer cows in four (8 percent) of the markets.

Overall, packing plants have improved their animal handling practices, but handling of cripples and downers is still a problem area. In a national study, Grandin visited 27 major hog and cattle packing plants and observed that five plants mistreated nonambulatory livestock. The most common handling problem at these plants was dragging conscious downers. These animals should have been stunned before dragging. These dragging incidents are a violation of the [Humane Methods of Slaughter Act of 1978](#), because they occurred after the livestock had been unloaded at the packing

plant. This act, which applies only to livestock that are on the premises of a USDA-inspected packing plant, requires the use of humane handling and stunning methods.

The regulations state, "The dragging of disabled animals and other animals unable to move, while conscious, is prohibited. Stunned animals may, however, be dragged" ([Federal Meat Inspection Regulations, 1979](#)). Many USDA inspectors permit dragging conscious animals off trucks parked on the packing plant premises, because it is unclear whether the inside of the vehicle is within the inspector's jurisdiction. The USDA has proposed an amendment to its regulations to allow inspectors to conduct ante-mortem inspection of downed animals on the truck. The animals could then be stunned on the truck before unloading.

Farm Management To Prevent Downed Cattle

Discussions with successful producers indicate that good management practices can prevent 8 out of 10 dairy cow downers. Marginal operators may be responsible for many of the emaciated downers that are too weak to walk. To reduce the incidence of downer cattle:

1. Educate dairy and beef producers on the proper use of calf pullers to help prevent calving paralysis.
2. Educate producers that a heifer or cow with small pelvic size should be bred to a bull that will produce a small calf, minimizing calving difficulties. Producers should use ease-of-calving performance information when selecting replacement and herd sires.
3. Educate producers about proper nutrition. Some downers are caused by milk fever. High-producing dairy cows may require the services of a professional nutritionist to formulate diets for gestation and lactation periods. Prompt treatment of milk fever will save the cows.
4. Practice good sanitation and milking practices to help prevent mastitis.
5. Keep hooves trimmed on dairy cows to prevent foot problems and potential falls.
6. Roughen smooth floors with a grooving machine or saw to provide nonslip footing. Install nonslip flooring in new facilities.
7. Handle cattle gently to prevent injuries and falls.
8. Follow recommended loading densities for trucks.

Methods for Moving Downer Cows

Use of a wide conveyer belt is one way to move downed cows. Three-foot-wide conveyer belting can often be obtained from mines inexpensively. The cow can be rolled onto the belt, and the belt can then be moved with a tractor. Harnesses are also available for lifting downer cows. The use of a harness requires ceiling space for a forklift or a lifting loader.

Dragging cattle by their legs or neck is cruel and should be avoided. Double-deck semi-trailers that regularly haul old dairy cows should have a side door in the belly compartment so downer cows can be rolled out the door instead of being dragged up the rear ramp. If a larger loader is available, a cow can be rolled into the bucket. If a cow goes down in the belly compartment of a semi-trailer that does not have side doors, humane removal is impossible; euthanasia is strongly recommended.

Calf Handling and Marketing Problems

Handling of newborn dairy calves at livestock markets may be a serious problem and is easily corrected. The [Code of Practice of the Welfare of Animals in Livestock Markets](#) in England and Canada does not permit the sale of calves under 1 week of age. In the province of Alberta, all calves arriving at a livestock market must be inspected by a veterinarian. Calves cannot be sold unless they can walk and stand without assistance. The hair coat and the navel must be dry. A similar practice should be adopted in the United States. Day-old calves that may be unable to walk should not be brought to an auction market.

A survey of nine New York livestock markets, conducted by the Humane Society of the United States in 1989, indicated

that large numbers of dairy calves were being thrown from vehicles and dragged during handling. Overall an average of 7 percent of the calves were thrown. The incidence at the two worst livestock markets was 25 percent; at two livestock markets, no calves were thrown. Thirty-one percent of the calves marketed were underage "wet calves." Of the nine markets surveyed, the livestock market with the lowest percentage of "wet" calves had 15 percent, while the livestock market with the highest percentage had 50 percent.

Dairy producers need to improve their marketing management and reduce calf abuse during unloading. Some dairy producers have thrown calves off their vehicles onto the unloading dock. Transporting calves in personal vehicles (such as the trunk of a car) to market or packing plants is not a humane practice and should be avoided.

A more desirable management practice is being conducted in large dairy States such as California. Calves are raised by producers who specialize in calf rearing. Employees from these operations pick up calves from dairies. In some cases, it may be beneficial to the health of the calf if the calf raiser acquires it from a dairy at an early age. The dairyman must feed colostrum shortly after birth, before the calf is picked up by the calf raiser. Failure to feed colostrum often results in a high death rate.

Crippled Downer Hogs

The incidence of crippled hogs that are unable to walk is much greater than the incidence of downer cattle. In cattle, a very high percentage of the downers are old animals that have reached the end of their productive life. In hogs, however, a high percentage of downers are young, finished, market-weight animals. Many downer hogs could be prevented by selective breeding and the use of non-slip floors. Fortunately, because of their small size, downer hogs, sheep, and goats are much easier to handle than downer cattle. They can be easily rolled into a cart and moved.

When a front-end loader is used to move a downed hog, one person must operate the machine while another rolls the hog into the bucket. Shoving a hog against a wall or fence to get it into the loader bucket is a bad practice and should be discouraged.

Hogs that are likely to become downers are:

- those that are crippled,
- old, weak, emaciated sows that were allowed to deteriorate into a weakened condition before being brought to a livestock market, or
- sick, decrepit animals brought to a livestock market by a producer who is feeding hogs under a contract. Some contract growers must bring such animals into the auction market in order to get credit for them from the contracting company. This practice should be avoided.

Farm Management To Prevent Crippled Hogs

To reduce numbers of crippled hogs:

1. Weak and/or emaciated sows that are unable to walk should not be accepted for sale at a livestock market. They should be either euthanized on the unloading dock at the market or transported immediately to a nearby slaughter plant.
2. Many downer hogs are caused by an inherited weakness in the hindquarters. Selection of breeding stock for soundness will reduce downers caused by spraddle legs.
3. Some hogs and sows have foot problems that are caused by improper flooring. The use of concrete flooring is preferable for finishing hogs and the breeding herd. Metal, woven wire, or plastic are acceptable in the farrowing house and nursery. The use of plastic, woven wire, or expanded metal floors in the finishing barn may cause excessive hoof growth that makes walking difficult. These types of flooring are suitable for younger pigs, however.
4. Install nonslip flooring in areas where hogs are driven, weighed, and loaded.
5. Producers should breed for a low incidence of Porcine Stress Syndrome (PSS). Hogs that carry the stress gene are more likely to be hard to handle and to go down. Some of these animals will recover if they are allowed to rest.

6. Hogs with hernias or prolapses should be marketed promptly or euthanized before they become weak and debilitated from either infection or a strangulated intestine.

Euthanasia

When euthanasia is required, humane methods must be used. The recommended method of euthanasia for cattle, hogs, and sheep that go down in a truck or at a livestock market is a captive bolt stunner or a gun. The captive bolt is safer than a gun, because it does not fire a free bullet. A blank cartridge propels a steel bolt into the animal's brain. This has the same effect as a gun and kills the animal instantly. Captive bolt stunners can be obtained from packing plant supply companies for about \$200. Figure 1 shows the correct position for stunner placement. Cattle are shot in the center of the forehead. Sheep are shot on the top of the head, and hogs are shot in the forehead. The same positions are used for a gun.

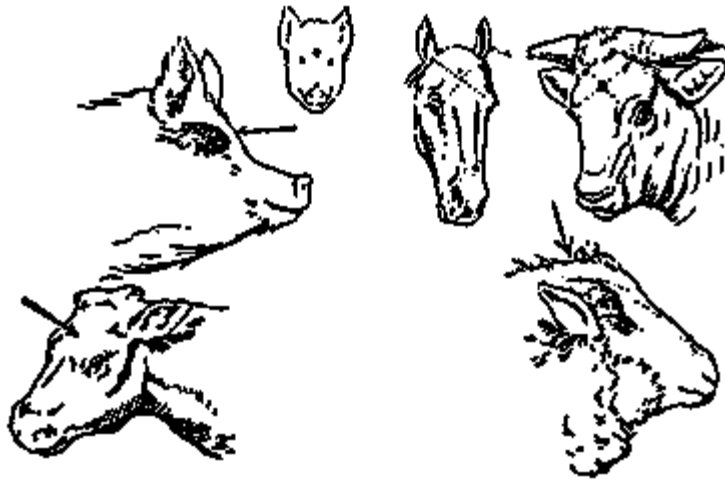


Figure 1. Correct positions for euthanizing livestock with either a gun or a captive bolt stunner.

Policies at Markets and Stockyards

Livestock markets should refuse to accept cattle and hogs that are unable to walk. Downed nonambulatory cows that are brought to a livestock market either should be immediately euthanized or should be transported directly to a nearby slaughtering establishment. Many livestock markets currently have a "no downer" policy. Some markets do not allow sellers to unload downers.

Many large cow slaughter plants have stopped accepting downers and very debilitated cattle. This has resulted in some severely crippled animals being shipped for several hundred miles. To prevent this, severely debilitated or nonambulatory cattle should be euthanized on the farm unless there is a local nearby slaughter plant.

In some States, dairies and feedlots use a portable slaughtering service to slaughter downed animals and salvage the meat. Another alternative has been proposed by Dr. Stanley Held, Minnesota. He proposes to inspect a downed cow on the farm, euthanize it, and then transport it immediately to a nearby federally inspected packing plant.

There is no simple answer to this problem that is both humane and economical. The first step is to upgrade movement of animals at the farm, livestock market, and packing plant, and reduce the number of downed animals that must be handled. Livestock organizations like the National Pork Producers Council recently have adopted strong "no downer" policies. Prevention, stronger policies, and proper handling methods should be acknowledged in assisting with practices affecting "downer" animals and newborn calves.

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Animal Welfare Issues:

HUNTING AND CONSERVATION ISSUES/GAMEBIRD SHOOTING PRESERVES

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INTRODUCTION

"Placing Hunting in Perspective," a publication from the Wildlife Management Institute ([WMI 1992](#)), defines hunting as:

. . .the pursuit of anything, with the intent to possess it. For example, the essence of bargain shopping, stamp collecting, mushroom harvesting, hunting, fishing and trapping is similar; only the specific objectives and tools used are different. Human use of products of the natural environment is ecologically and socially acceptable (and legal) in all 50 states, provided those uses do not harm the environment's ability to renew or sustain the resource, and are conducted legally, safely and responsibly.

The Wildlife Society, founded in 1937, is a professional, nonprofit organization with more than 9,000 professional members. It is dedicated to the wise management and conservation of the wildlife resources of the world. In its conservation policies, The Wildlife Society ([TWS 1992](#)) states that it "supports and promotes the philosophy of humans responsibly using wildlife for food, clothing, shelter, hunting, fishing, trapping, recreation and as an indicator of environmental quality. These uses contribute to the economic, environmental and spiritual well-being of society." The Society further states that it "supports and promotes the position that humans are responsible for promulgating and enforcing laws and developing management programs essential to sustaining the long-term welfare of wildlife."

For some species, regulated hunting serves as a means of helping maintain wildlife populations in balance with available habitats. According to recent estimates ([WMI 1992](#)), there are about 18.5 million recreational hunters in the United States.

DISCUSSION

The concept of gamebird shooting preserves, where game to be hunted is reared in confinement and released for recreational hunting, originated in Europe and Great Britain and spread to this country after 1900. Interest in shooting preserves has grown steadily in recent years, largely because of increased difficulty of public access to private lands for hunting; continued demand for recreational hunting and shooting opportunities; changing demographics, with resulting time constraints on participants; and the continued need for other opportunities to train and work hunting dogs. Some facilities also offer a place to participate in other recreational shooting sports, such as skeet, trap, or sporting clays. Another factor causing increased interest in shooting preserves is that wild populations of certain gamebirds, and access for the privilege of hunting them, have declined significantly in many areas because of changes in land use and ownership. Properly managed shooting preserves can provide recreational hunting and shooting opportunities to many who might otherwise lose interest. They also encourage owner/operators to manage habitats to the benefit of gamebirds and other wildlife species.

Recreational hunting on shooting preserves is attractive to many people for a variety of reasons. With the progressive loss of wildlife habitat and public access, shooting preserves provide an acceptable alternative for many recreationists who desire to hunt or shoot recreationally, but lack available access or time. The U.S. Department of Agriculture Natural Resource Inventory ([USDA 1990](#)) says that the United States is losing 4,000 to 5,500 acres of agricultural lands each day. Increasing urban expansion and development is also destroying available habitats for many wildlife species. Shooting preserves help to reduce hunting pressure on some upland gamebird species on which changing land uses and habitat losses are having the greatest impacts.

Regulated hunting has been proven to have little or no detrimental effect on wild gamebird populations when habitat of sufficient quantity and quality is available. Many studies have shown that some renewable wildlife resources, such as certain upland gamebirds, may have an annual turnover of 70 to 80 percent, whether they are hunted or not. These studies indicate that even when some gamebirds are harvested from gamebird populations by hunters each year, they can sustain enough reproductive capability to replace the losses if enough good-quality habitat is available. Wildlife managers use a variety of management practices to ensure that the annual harvest does not exceed a population's ability to sustain itself. Gamebird shooting preserves afford managers an opportunity to provide released birds to increase hunting opportunity without potentially overharvesting wild bird populations.

Well-managed shooting preserves for upland game birds can provide economic benefits for owners, operators, and the community. The 1985 Farm Bill's Conservation Reserve Program (CRP) allowed landowners to sign up large acreages of farmland to be planted in grass or trees under various set-aside, conservation, commodity, or other Federal programs. In some areas, particularly the Great Plains region, upland gamebird populations have increased significantly. This increase is stimulating interest by hunters and the increased hunter expenditures are contributing economically to rural communities. Some of this increased interest in upland gamebird hunting is likely to stimulate more interest in shooting preserve opportunities in the future.

As hunting preserves have increased, so have questions regarding the potential effects that release of pen-reared birds could have on diseases, genetics, and other environmental concerns. Still others question the value issue of hunting released species for recreation and food.

Data reviewed recently indicate that few adverse impacts have been documented when pen-reared gamebirds such as quail and pheasants have been responsibly released into habitats where native wild quail and wild pheasants live. In a recent workshop, "The Effects of Released, Pen-Raised Bobwhites on Wild Bird Populations" ([Landers 1991](#)), researchers reported preliminary findings of interaction between pen-raised/released and wild bobwhite quail. Considerable scientific information is available on wild gamebird populations and their management and on pen-reared populations and management, but little is available on the impact of one on the other. However, there is substantial

evidence that pen-reared/released turkeys significantly increase disease and parasite transmission and genetic pollution, resulting in poor survival and population sustainability. Today, however, turkeys are rarely produced for shooting preserves. Successful reintroduction of wild turkeys and management of restored wild bird populations have resulted in huntable populations in 49 of the 50 States. Release of pen-reared turkeys into the wild is not encouraged, and in fact many States have passed regulations to prevent such releases.

Wildlife diseases and parasites are difficult to monitor in wild populations. However, there is little substantiated evidence that outbreaks have been caused by pen-reared gamebirds such as quail or pheasants. Most ground-dwelling birds that become affected by disease are likely to become a victim of predation. In addition, scavengers are abundant in most gamebird habitats, and birds that succumb to disease are usually consumed either before or shortly after death occurs.

The bobwhite quail is the upland gamebird most commonly released on shooting preserves, particularly in the southeastern and midwestern regions of the United States. Clearly, the steady decline of wild bobwhite quail populations across the Southeastern United States is a widespread concern among wildlife researchers, State fish and wildlife agencies, other natural resource professionals, landowners, and hunters. Considerable research continues to be directed at this decline; however, it seems obvious that the decline is unlikely to have been caused by any single factor, but has resulted from a combination of causes.

Studies have identified several factors causing the decline of wild bobwhite quail populations: (1) changing land use, including agricultural practices, (2) pesticides, (3) climatic changes, and (4) change in predator population status. Whether release of pen-reared bobwhites is a contributing factor in this decline is not yet known.

The wild bobwhite population decline appears to be widespread. Declines have been observed where no pen-reared birds have been released, as well as in areas where releases have been made for years. While disease may have played a role in the decline of wild bobwhite quail populations, no disease outbreak has been documented that has been traced back to that of pen-reared birds. For example, quail pox virus is endemic in wild bobwhite quail populations in the Southeastern United States. Several cases of positive quail pox virus isolation have been reported from wild bobwhites on areas where historically no pen-reared birds have been released. This virus has been isolated from both wild populations and pen-reared quail.

These conclusions do not mean that the gamebird industry is, or can afford to be, lax about disease issues. The potential transfer of disease should always be a major concern of gamebird breeders and shooting preserve managers or other individuals who plan to release pen-reared birds.

There is no excuse for ever releasing an unhealthy bird. It is in the best interest of the gamebird industry to produce the healthiest birds possible. It is also in the best interest of shooting preserve owners or managers to neither buy nor release sick or diseased birds. Substandard gamebirds will not perform satisfactorily and will create dissatisfied customers. In addition, most gamebird breeders and shooting preserve owners and managers recognize these concerns and want to prevent practices that might pose a threat to native wildlife species or to the ecosystem. As noted in "Shooting Preserves in South Carolina" ([Harrigah, Yarrow, and Baker 1990](#)), "A shooting preserve without quality birds will not be in business very long." The chapter on gamebird diseases in "Hunting Preserves for Sport and Profit," ([Schwartz and Vezey 1987](#)) emphasize prevention of disease and provides a list of guidelines. The authors, both of whom are doctors of veterinary medicine, provide three pertinent conclusions:

- diseases of pen-reared birds are not usually a serious threat to native birds that may be in the areas where the pen-reared birds are released,
- preserve operators should never knowingly release sick birds, and
- prevention of disease should be a preserve operator's primary goal. Treatment is an emergency procedure that is frequently inadequate.

In a workshop, "The Effects of Released Pen-Reared Bobwhites on Wild Bird Populations," ([Landers 1991](#)) participants defined the following questions as high-priority research topics:

- If pen-raised quail interact with wild quail, what social relationships, if any, develop?

- Do pen-raised quail compete for food, space, mates, or other resources?
- Is survival of pen-raised quail favored by certain release techniques or genetic stock?
- If pen-raised quail survive the breeding season, what impact might they have on wild quail populations?
- Are predator-prey relationships altered by the introduction of pen-raised birds?
- Are wild turkey or other native wildlife populations jeopardized or influenced by the introduction of pen-raised quail?
- What impact does the gamebird propagation and release industry have on the public's perception of hunting?

The answers to these questions may be a few years away. Some may never be answered to everyone's satisfaction. However, they do indicate the continuing interest by wildlife scientists, veterinarians, game bird breeders, hunters, and shooting preserve owners and managers to provide sustainable wild populations of gamebirds for future recreational use and enjoyment.

SUMMARY

Hunting in the United States is permitted on many public lands by State and/or Federal natural resource management agencies. However, more than two-thirds of the lands within the contiguous United States are privately owned and managed. There is a great disparity of ownership as well, with about 90 percent of all public lands located in the West, but with the great majority of the human population living in the East. It is reasonable to conclude that demand for hunting access to private lands is likely to increase and that some of the demand will be met by shooting preserves. Many shooting preserves offer gamebird hunting along with other recreational opportunities, such as dog training, skeet shooting, trap, sporting clays, and other shooting sport activities. Location, management, marketing, and customer satisfaction are keys to the successful operation of shooting preserves. It is likely that gamebird shooting preserves will continue to meet clientele needs for recreational activities.

Hunting provides the backbone of support for fish and wildlife agencies across the Nation, and it will continue to play a significant role in perpetuating and funding responsible wildlife management. Well-funded programs, including regulated hunting, will result in wise stewardship of wildlife resources, continue to provide recreation for all wildlife users, and contribute positively toward the future sustainability of our wildlife heritage.

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Animal Welfare Issues:

POULTRY

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INTRODUCTION

The focus of the commercial poultry industry is the production of meat and eggs under intensive husbandry. The egg component includes production of white and brown eggs that are either marketed in the shell, bulk processed, or sold as value-added products. Current production consists of approximately 245 million layers, of which about 98 percent are maintained in cages.

The meat component of the poultry industry consists primarily of chickens and turkeys, although there is also a relatively small amount of waterfowl and gamebird production. Turkey production, which has largely moved from range rearing to total confinement rearing on litter floors, has grown rapidly from 185 million birds in 1985 to about 300 million today. Unlike chicken production, where reproduction is by natural mating, essentially all breeder turkeys are maintained in sex-separate flocks and reproduction is via artificial insemination.

During the past half century, chicken meat production has changed from being a byproduct of the egg industry to an industry in its own right, with annual production of more than 7 billion broilers and roasters. Nearly all broilers and roasters are reared in confinement on litter floors, while breeders are confined in 1/3 litter and 2/3 slat houses. The feed intake of breeders is carefully regulated in order to maintain targeted weights and prevent obesity.

The poultry industry is the largest (in terms of animal numbers) and the most highly automated, vertically integrated, and intensified of the animal production industries. As a consequence, there has been a great deal of public concern about the welfare of poultry. This concern, in turn, has stimulated a substantial scientific research effort, particularly in Europe. Several of the more significant welfare concerns pertaining to poultry are discussed in the sections that follow. It should be kept in mind that many factors must be considered when evaluating the welfare implications of a particular management procedure, including the health, productivity, physiology, and behavior of the animal.

LAYING HENS

Caging

The battery cage system for laying hens was introduced commercially on a wide scale in the 1950's. Since that time, it has become the predominant method for maintaining hens. Cages provide the egg producer with an efficient and cost-effective means of collecting eggs, disposing of wastes, reducing feed wastage, maintaining an adequate environmental temperature, and inspecting the condition of individual birds.

Cages have come under increasing criticism, however, largely because of the behavioral restrictions that are imposed upon the birds. Cages do not provide an environment that allows the expression of behaviors like nesting, perching, and

dustbathing. Space allowances for laying hens have also been criticized, although how space allowances should be determined is an extremely controversial topic (1). In their "Recommended Guidelines of Husbandry Practices for Laying Chickens," the United Egg Producers suggest 48 square inches per bird as a minimum space requirement for caged hens; however, the European Community has mandated a minimum allowance of 75 square inches per bird. (In many European countries, heavier bodied brown egg layers are preferred to the lighter bodied white egg layers used in the United States. Both the European and UEP guidelines can therefore be interpreted as providing a minimum space allowance of 12 square inches per pound of liveweight, although it is more common to express space allowances on a per-bird basis.) Some European countries have either increased this allowance or outlawed battery cages entirely. Several alternative production systems are being investigated in Europe. These vary from more intensive systems like the get-away cage or the Edinburgh cage (modified battery cages containing perches, dustbaths, and nestboxes) to more extensive systems like aviaries, straw yards, and free range (2,3,4).

It is still unclear whether the more extensive alternative systems will prove to be economically viable and also result in improvements in welfare. In general, both egg prices and mortality have been found to increase in these systems. In Britain, for example, free range eggs cost about 50 percent more to produce than cage eggs (5), largely due to increased labor costs. Mortality is approximately 4 percent in cages, 9 percent on litter, and 16 percent on range (6). Most mortality on litter is due to cannibalism, which represents an important welfare problem for the bird that must be carefully balanced against the importance of providing opportunities for the expression of behaviors. In general, cages still provide the best means for insuring bird health and egg quality and safety. The cage manufacturer's recommendations for stocking density should be followed. Modified cages like the Edinburgh cage (4) are promising alternatives to conventional cages.

Beak and Toe Trimming

Cannibalism sometimes occurs in poultry, and outbreaks can result in significant injury and mortality in flocks. A common procedure to reduce the incidence of cannibalism is beak trimming, which involves removal of approximately 1/2 of the beak. Beak trimming is a part of routine husbandry for laying hens, but its use in broiler production is much less common. The beaks of male turkeys may be trimmed to reduce injuries associated with aggressive behavior.

Although there are numerous publications on beak trimming, controversy exists concerning if, when, and how trimming should be performed. Studies have shown that traditional hot-blade beak trimming after 5 weeks of age can result in both acute and chronic pain (7,8,9). Precision trimmers that cut a small hole in the beak causing the tip of the beak to fall off several days later are now available; this method of beak trimming has not been thoroughly evaluated from the point of view of pain. There are currently no husbandry procedures except reduced light intensities that represent viable alternatives to beak trimming, although recent evidence suggests that genetic selection could be used to decrease the incidence of cannibalism in flocks (9).

Beak trimming should not be used indiscriminately, and a judgment must be made as to whether the discomfort involved is necessary in order to prevent or reduce future behaviors that may be deleterious to the bird. When cannibalism occurs in a flock, beak trimming becomes therapeutic. When the decision is made to beak trim, it must be done properly to minimize long-term effects on behavior and production. Guidelines for beak trimming different strains of birds are available from the major breeders.

Toe-trimming is also sometimes used in commercial poultry production. The middle toe of laying hens may be removed to reduce eggshell damage, and the toes of breeder chickens and turkeys may be trimmed to prevent injuries to other birds. Trimming one toe of breeder chickens does not appear to cause chronic pain when performed properly (10).

Induced Molting

The past decade has seen an increasing trend in the recycling of layers through induced molting. In birds, plumage is normally replaced before sexual maturity. This process, called molting, also occurs after sexual maturity and is associated with a pause in egg production, which can be lengthy if birds are permitted to molt naturally. Inducing hens to molt rapidly extends their productive life and has become a common procedure in the recycling of layers.

There is considerable literature on induced molting ([11](#)). Techniques used to induce molt include feed restriction; a change in light cycle; manipulation of dietary ingredients such as calcium, iodine, sodium, and zinc; and administration of pharmaceutical compounds that influence the neuroendocrine system, sometimes coupled with a reduction in photoperiod. These procedures cause an abrupt cessation of egg production coupled with loss of body weight and feathers. Restoration of egg production is accomplished by initially feeding a diet designed to meet the nutritional requirements for a non-ovulating, feather-growing hen, followed by feeding a normal laying hen ration.

The most common procedure used to induce molt is feed withdrawal. Its popularity as a molting method is probably due not only to its efficacy, but to the elimination of feed costs during the withdrawal period. Unfortunately, there is a paucity of data on the well-being of hens during the withdrawal and postwithdrawal periods, although feed deprivation is known to result in both increases in stress hormones and behavioral changes in poultry ([1](#)). Until more information is available, programs that minimize the length of the feed withdrawal period ([7](#)) should be used whenever possible.

MEAT PRODUCTION

Health Problems

During the past half century, genetic selection, heterosis, changes in husbandry, improved nutrition, and control of diseases and parasites have contributed to the escalating growth rate of meat-type poultry. In the 1940's, broilers required 12 weeks to reach a market weight of 4.4 pounds; today they achieve this weight in 6 weeks, and the reduction by the industry of 1 day per year to achieve this weight continues unabated. Comparable changes have occurred in turkey and waterfowl production. The result is greatly improved efficiency of feed utilization because of reduced maintenance.

Several health and welfare problems seen predominantly in meat-type birds are related to rapid growth rate. A correlated response to the selection of turkeys for increased body weight and a broad breast is the development of deep muscle myopathy (atrophy of the inferior pectoralis muscle) caused by an inadequate blood supply to the tissues. Both turkeys and meat chickens exhibit skeletal disorders, particularly in the bones of the pelvic limb (femur, patella, tibia, metatarsus) and their associated tendons. These disorders are not necessarily associated with body weight or conformation, but instead with the differential growth of body parts, particularly accelerated growth of muscle that is not commensurate with skeletal development. Skeletal abnormalities can be further exacerbated by the resulting motor impediments. The lack of synchronous growth among body components in broilers, including the heart and lungs, can contribute to pulmonary hypertension causing excess fluids in the body (ascites). An additional problem is "sudden death syndrome," the cause of which is unknown.

These health problems are of great concern to the poultry industry, and considerable research is being conducted on the negative aspects associated with rapid growth in today's broilers. Relationships are complex, and in some cases neither genetic nor non-genetic solutions are readily available. Some alleviation, however, may be feasible by moderating growth during certain periods in the bird's life.

Feed Restriction

Broilers and their parent stock have the potential for rapid early growth and eat at or near the capacity of their gastrointestinal tract when fed ad libitum. Thus, unless the feed intake of broiler breeders is limited, the resulting obesity will have negative effects on reproduction, vigor, and viability. Under current commercial feed restriction programs, breeders are fed an amount of feed either daily or on alternate days that is calculated to achieve and maintain preferred body weights. Feed restriction of this type has been shown to be a stressor in broiler breeders, resulting in increases in activity, aggression, stress hormone levels, and the performance of stereotyped behaviors ([1](#)). Although the health benefits of commercial feed restriction programs to the bird outweigh these negative aspects, alternative methods for controlling body weight in breeders require investigation.

Crowding

Much concern has been expressed about the negative effects of crowding in floor-housed and caged flocks with respect to air quality, disease incidence, and aggression. Crowding in both broilers and laying hens may lead to higher mortality and decreased growth and reproduction in individual birds, although overall economic returns from the flock may be greater ([12](#), [13](#)). However, there is little evidence to support the view that crowding increases aggression in broilers. Broilers are very docile and are also marketed at such an early age that they have not yet formed a dominance hierarchy ([14](#)).

TRANSPORTATION, SLAUGHTER, AND CULLING

Birds being sent to slaughter are hand-captured, crated, and transported by road over varying distances to the processing plant. Many elements of the transport process can be harmful to the bird ([15](#),[16](#)). These include handling by humans, air temperature changes, removal of food and water, novelty, confinement, noise, motion, and mixing with unfamiliar birds. Improper handling and transport may also result in mortality, bruising, and bone breakage, with the latter representing a particular problem with spent laying hens. Mechanical harvesting may be less stressful to the bird than human handling ([17](#)). However, many problems have been encountered with regard to the maneuverability of harvesting machines in commercial houses. Whether harvesting is done by hand or machine, care should be taken to handle birds gently during capture and crating and uncrating. Stress should also be minimized during transportation. USDA has developed guidelines for air transport of chicks and hatching eggs ([18](#)).

Meat birds are slaughtered by being shackled and electrically stunned in a brine-water-bath stunner, followed by the severing of the vertebral and/or carotid arteries with an automatic knife. The stunning currents used are intended to render the bird insensible temporarily until bleed-out is completed. Laying hens are usually not stunned, because their bones, which may be osteoporotic due to lack of exercise and the high rate of calcium usage for egg formation, break during the application of an electrical current. Stunning is also not used for some religious slaughter methods.

Surveys in Europe have shown that approximately 30 percent of birds processed using a bath stunner are inadequately stunned before slaughter ([19](#)); no comparable surveys have been conducted in U.S. processing plants. Research is currently being conducted in England on the welfare aspects of stunning to induce cardiac arrest and on the use of gas (carbon dioxide plus argon) stunning ([20](#)). Additional research is needed on the commercial utility of alternative stunning methods. At present, electrical stunning should be carried out carefully to ensure maximum efficacy ([21](#)).

Because they have little market value, spent hens may now be slaughtered on-farm. Carbon dioxide delivered via a mobile killing unit with an on-board delivery system, cervical dislocation, or instant maceration using a specially designed high-speed grinder, are acceptable

In the past, unhealthy chicks or surplus male chicks were killed at the hatchery by suffocation. This practice has essentially been abandoned by the U.S. poultry industry in favor of more humane methods like maceration, which result in instantaneous death.

SUMMARY

To ensure the health and productivity of their flocks, poultry producers should continue to employ the "best management" practices recommended by equipment manufacturers, breeders, trade organizations, and scientists. Current societal concerns about the welfare of animals in confinement, however, also require us to consider the behavioral need of animals. More research is required to determine if husbandry practices need to be modified to improve well-being, as well as to assess how this can be accomplished in a manner that is economically viable for producers and consumers.

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Animal Welfare Issues:

RABBITS

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INTRODUCTION

Domestic rabbits are raised primarily for commercial, show, or pet purposes. Commercial use involves the production of meat, pelts, and wool and the production of live animals for breeding and laboratory stock and for pets. With an increasing trend toward urbanization, rabbits make a good choice for youth projects. Their small size and low initial investment are part of their attraction. Teachers often use rabbits as small animal projects in the classroom. For some children the classroom rabbit may be their first contact with an animal other than a dog or cat.

In the United States, a large number of people involved with rabbits are fancier -- people who rear rabbits for show purposes. Although this group may not directly seek advice from an Extension agent, they may serve as a source of information and assistance. The American Rabbit Breeders Association, Inc., is one group that deals with many aspects of rabbit production. They set standards of perfection for judging and sponsor a variety of events for rabbit enthusiasts.

The "Easter Bunny Syndrome" makes rabbit producers particularly vulnerable to criticism. Rabbits are naturally "cute" and possess physical attributes that attract the affection of most people. The production of rabbits as a source of food and fiber has been addressed by animal protection groups (Humans Against Rabbit Exploitation). Questions of humane use and production methodology concerning rabbits are similar to those raised about other intensively raised species such as swine, poultry, and veal calves.

As animal protection actions and concerns continue to rise with regard to the acceptability of standard husbandry practices, people involved in the production and use of rabbits (as a food and fiber resource or 4-H project) need to be aware of potential problem areas. Several commercial production practices may be targeted as welfare concerns:

- confinement rearing,
- post-partum breeding,
- wool harvesting methods,
- fur production,
- transport,
- slaughter,
- sales.

DISCUSSION

Confinement Rearing

In the wild, rabbits are social, group-dwelling animals. A system of burrows is constructed that collectively is referred to as a warren. The social group usually consists of one to three males and one to five females. The social organization of the group is matriarchal, with females constructing the hierarchy and males being attracted to the group. A pecking order is also established among the males in the group. Primary competition among females is centered on access to breeding warrens, while males focus on breeding privilege. The dominant buck defines the group territory by scent-making (glandular secretion, urine, and feces) ([Lockley, 1954](#); [Harkness, 1988](#)).

Controversy over the confinement rearing of social species of livestock (calves, poultry, swine) has been a primary welfare issue. Although little attention has been focused on rabbits, it is reasonable to assume that the same complaints of space restriction and social deprivation are tenable. Rabbits are usually caged in groups before sexual maturity and individually as adults. Most fryers (young rabbits harvested for meat), are group-raised littermates. Fryers are marketed at a target age of 56 days but may not attain market weight until 70 days. Commercial rabbit producers house rabbits in caging systems with cage sizes adjusted for breed of rabbit, management system, and intended purpose (e.g., breeding adults vs. laboratory stock). Because of the ventilation problems inherent in multi-deck caging systems, most large rabbitries have a single deck of cages. Water is usually provided by an automatic watering system, and food is hand-distributed to each cage ([Cheeke, 1987](#); [McNitt et al. 1996](#)).

Possible welfare concerns may include social deprivation (in the case of singly housed adult breeders), cage sizes, and stocking densities of group-raised market animals. Adult rabbits generally are not housed in groups. Because of the rabbit's territorial nature, each cage is regarded as an individual's own territory by both sexes. Scent marking occurs, and if other rabbits are introduced, fighting is prevalent ([Harkness, 1988](#)). Studies have been undertaken in Europe to develop housing systems for breeding groups that reduce competition and fighting among group inhabitants ([Stauffacher, 1986](#)). A 3-year study in Canada indicated that rabbits could be successfully group housed on the floor in a facility with smooth concrete floors and epoxy-treated block walls. The rabbits were grouped at 8 to 9 weeks of age. Grouping older rabbits required the use of tranquilizers or castration to avoid fighting ([Love and Hammond, 1991](#)). A New Zealand study reported that group-housed does have a significantly lower proportion of young alive at 21 days postpartum than does individually housed in boxes ([Muller and Brummer, 1991](#)). However, further study is needed to assess whether well-being is compromised for certain group members and the overall impact on production.

Work has been carried out to determine the effects of environmental enrichment on rabbit performance. This generally has been positive and enrichment objects introduced into the cages have caused stimulation and increased activity ([Huls et al., 1991](#); [Brooks et al. 1993](#)). Enrichment objects have included wooden dowels, wooden rings, a brass wire ball and empty aluminum beverage cans. These authors also provided PVC "tunnels" between two cages so the adult female rabbits could be apart or together. Given such a choice, the rabbits spent 90% of their time together. A two tier cage provides spatial enrichment without increasing floor space requirement ([Finzi, 1996](#)). The rabbits evidenced no preference for the upper or the lower part and, on average, used both parts with equal frequency.

In market rabbits, stocking densities have been studied to determine the effect of rabbit density on growth and consumption parameters. High stocking densities may result in rabbits reaching slaughter weights 3 to 5 days later than rabbits housed at lower densities ([Maertens and DeGroote, 1984](#)). Singly housed control animals reached slaughter weight an average of 1 week earlier than group-raised rabbits. Fur-plucking and ear-biting were behavioral manifestations attributed to overcrowding. Studies conducted at Oregon State University show no consistent difference in rate of gain, feed efficiency, and mortality when rabbits were stocked at densities of 930, 465, and 310 cm² per rabbit in either conventional or large pens ([Lukefahr et al. 1979](#); [Harris et al 1981](#); [Prawirodigdo et al. 1985](#)). European studies have produced similar results. However, confusion remains as to the most productive stocking density. One study found that 500 cm² per animal gave the best overall performance results ([Ferreira, 1984](#)), while another reported that densities of 583 and 700 cm² per animal were detrimental ([Petersen et al. 1988](#)). Hamilton and Lukefahr ([1993](#)) found no significant mean differences in feed intake, feed efficiency, survival rate and uniformity of final weight for rabbits housed at 929, 465 or 310 cm² per rabbit although the rabbits in the first group had better numerical means for all four traits. Recent studies in France have indicated that there are reduced social interactions and locomotory activities with less than about 650 cm² per animal. It was reported however that even at high densities aggressive encounters were uncommon and mixed sex housing did not result in major problems ([Morisse and Maurice, 1996](#)). Similarly, Bell and Bray ([1984](#)) found that the sex composition of rearing groups had little effect on weight gain, feed intake or mortality from 30 -93 days of age. The incidence of injuries in male rabbits 60 to 80 days of age increased significantly as the size of the group increased from 15 or less to 16-30 or over 40 animals ([Bigler and Ester, 1996](#)).

In recent years, advocacy of "free-range" systems as an alternative to confinement raising has become a popular topic in the animal welfare and sustainable agriculture arenas. Some concern has also been raised that wire floors are not a suitable substrate for rabbits and may result in increased incidence of ulcerative pododermatitis (sore hocks) ([Drescher, 1992](#); [Drescher and Schlender-Bobbis, 1996](#)). Rommers and Meijerhof ([1996](#)) compared several alternative floors for

cages. These included slats and several configurations of synthetic meshes. Most resulted in less footpad injuries than wire floors but did not influence the production of the does. Because of the increased expense of the alternative floors, production costs were increased and profits reduced. There is little data to compare caging systems to "free-range" systems. One study, which compared cage-reared to floor-reared meat rabbits, found that production performance of rabbits was similar between the two housing systems up to 70 days of age. After 70 days, stocking density became an important factor ([Crimella et al. 1988](#)). A concern is the spread of coccidiosis in floor-reared rabbits. Future research that focuses on different production philosophies and their companion systems can help to elucidate the benefits of each system to both humans and animals ([Cheeke, 1979](#); [Harkness, 1988](#)).

Post-Partum Breeding

Post-partum breeding is a common practice among rabbit producers in Europe ([Camps, 1983](#)). After kindling, does are re-bred within 48 hours. This practice has been condemned by animal protection groups despite the fact that wild rabbits re-breed in the same manner ([Lockley, 1954](#); [Harkness, 1988](#)). One British publication does not recommend re-breeding until 3 to 7 days post-partum on welfare grounds ([King, 1988](#)). In the United States the majority of producers re-breed at 14 or 35 days post-partum. There is no direct advantage in re-breeding at 1 day versus 14 days post-partum in terms of the total number of kits weaned ([Harris et al. 1982](#)).

Wool Harvesting

Wool harvesting practices also have the potential to become an issue. Angora rabbits grow a low-density fine fiber that produces light-weight warm garments. Wool harvesting can be accomplished by shearing or plucking ([Schlolaut, 1987](#); [Kilfoyle and Samson, 1988](#)). Some countries have banned the plucking of wool on the grounds of cruelty. Plucking, when done properly, involves the testing and removal of loose hair, preferably during molt. However, some types of Angora rabbits (e.g., German Angora) do not molt readily and should not be plucked ([McNitt et al. 1996](#)). Theoretically, plucking removes only the longest fibers and leaves the undercoat to protect the rabbit. It does, however, damage the follicles and change the composition of the coat, thereby reducing the lifetime wool yield ([Schlolaut, 1987](#); [Kilfoyle and Samson, 1988](#)).

Shearing is more widely practiced in the United States. Proper handling and methods of restraint should be utilized to ensure protection from nicks and cuts during the process. Other welfare considerations include protection from temperature extremes. Rabbits should have from 1/4 to 1/2 inch of wool left on the body and should not be sheared or plucked during particularly cold months. When temperatures drop to 35 °F or less, rabbits should be provided with warm quarters and a nest box until the wool has reached at least 1 inch in length ([Vermorel, 1988](#); [Vernet, 1988](#)).

Fur Production

The fur industry has been under attack by animal activists for several years, with a dramatic escalation in the past 5 years. Ethical and welfare arguments have been advanced with regard to the necessity for fur garments and the methods used to capture wild fur-bearing animals or to produce and euthanize ranched species ([Nilsson, et al. 1980](#); [Commission of the European Communities, 1991](#)). In the United States, few rabbits are commercially grown specifically for their pelts. Most rabbits raised for pelts are of the Rex breed ([McNitt, 1988](#)). In the Rex pelt, the guard hairs and underfur are of the same approximate length. This provides a dense, even pelt useful for garment manufacture. The monetary value, however, is not sufficiently high and is generally not a profitable enterprise ([McNitt et al. 1996](#)). Unlike other species of ranched fur-bearers where the pelt is the only product produced, the rabbit carcass can be used for meat. Although this is of little comfort to activists, the general public may be more accepting of the use of the entire animal, rather than killing for just the hide.

Transport

The transport of rabbits to processing facilities can pose welfare questions similar to those raised for other livestock species. Separation, caging, crating and handling practices, mixing, food and water deprivation, noise, temperature,

humidity, and other environmental changes are all variables that affect the physical and psychological welfare of animals. Transport has been shown to affect meat in rabbits by increasing the rate of muscle glycogen depletion, which causes dark, firm, dry meat; increasing plasma glucose; increasing liver glycogen (during long hauls); and decreasing liver weights ([Jolley, 1990](#)). Having water available reduces live weight and carcass losses associated with antemortem handling ([Coppings, et al. 1989](#)). More research is needed to elucidate transport stressors and to recommend improvements. In the meantime, humane handling and hauling practices should be encouraged and practiced.

Slaughter

Humane slaughter has been and will continue to be a concern of both animal user and animal protection groups. Unlike other farm livestock, rabbits are not covered by the Humane Slaughter Act ([Anon. 1906](#)); however, interest is high in securing more humane methods for stunning ([Anon. 1992](#)). Rabbits that are processed in commercial facilities undergo electrical stunning, which renders the animal unconscious, and then are decapitated. In smaller processing facilities or on-site slaughter, however, manual methods are used. Two methods have been recommended for manual stunning ([Arrington and Kelly, 1976](#); [Sandford, 1986](#)). The first method is cervical dislocation. When performed by a competent person, cervical dislocation renders the rabbit unconscious immediately. The second method involves the use of a blunt stick to strike the rabbit behind the ears at the base of the skull. Generally, cervical dislocation is the preferred method for manual stunning. Welfare problems arise when inexperienced personnel attempt to perform the stunning. Care should be taken to properly train personnel before they attempt to manually stun a rabbit. Trainees should learn the proper way to handle the rabbit to reduce excitability and stress; observe the technique being performed by a competent individual; and perform the technique under supervision until competence is attained.

Sales

There is a real possibility for problems for producers who rear rabbits for sale to laboratories for use in consumer product testing. Consumer product testing procedures that specifically use rabbits, such as the Draize eye irritancy test, have been major animal welfare and rights issues for the past 10 years. Another important consideration for producers who sell stock for purposes other than food or fiber is compliance with U.S. Department of Agriculture (USDA) regulations under the Animal Welfare Act. Rabbit producers who sell to buyers other than processors or individuals purchasing the rabbits for their own use must be licensed by USDA if their gross sales exceed \$500 per year ([USDA, 1990](#)). USDA sets facility standards and specifies the management practices that must be followed, and inspects facilities to assure compliance. Public complaints about producers are directed to USDA for consideration. Pet stores, carnivals, and other animal sellers or exhibitors often purchase stock from unlicensed producers because of lower prices. This practice should be discouraged, because it discriminates against licensed producers. This practice also leaves the industry open to criticism for non-compliance with the Animal Welfare Act.

CONCLUSION

Ultimately, it is up to rabbit producers to ensure that they provide for the needs of their rabbits. Proper housing, appropriate and adequate feed, ventilation, clean water, health management, and environments designed to decrease stress are all important contributors to rabbit well-being. Research is needed to further determine factors that contribute to both physiological and psychological well-being of domestic rabbits.

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Animal Welfare Issues:

SHEEP AND GOATS

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INTRODUCTION

Concern for the welfare of production animals has focused primarily on intensive confinement systems. Sheep production in the United States is relatively free from criticism because most sheep are grazed in flocks, and lambs remain with their dams for several weeks before weaning. In addition, sheep production is a relatively small segment of animal agriculture and does not attract as much attention as other animal industries.

Several sheep management procedures have been criticized, however. These include practices such as shearing, use of dogs for herding, and frequent physical handling. Castration and tail docking are procedures also used in other species, but have specific relevance to sheep in that several methods are commonly used for both of these procedures. When sheep are managed in confinement, for lambing or throughout their production cycle, problems such as mis-mothering of lambs and wool-picking may occur at a higher rate than when they are kept in more extensive systems. Raising sheep on pasture or range also draws criticism over such issues as predator control and exposure to severe weather. Many of the concerns about sheep production also apply to raising Angora goats for mohair. Dairy goats are more often subjected to restraint and confinement than sheep, and may be dehorned and de-scented.

DISCUSSION

Personnel, Equipment, and Facilities

Appropriate personnel, equipment, and facilities are essential to attain the highest standard of animal welfare in any operation. Well-trained, skillful, and conscientious personnel should be used whenever possible when handling sheep. This is particularly true for procedures such as shearing and hoof care. Novice personnel should receive training and supervision from experienced co-workers or more formally in junior college, university, or extension classes.

Part of the training of personnel should include proper care and maintenance of equipment. Wool shears, hoof trimmers, castrating tools, and other equipment should be appropriate to the task performed and in good working condition. Handling facilities should be designed for the task and species they are used for and maintained in good condition. Designs for various facilities are available from extension agents or consultants.

As with all agricultural species, welfare concerns involving sheep include topics not directly related to the on-farm production system. Transportation, marketing, preslaughter treatment, and slaughtering methods all affect an animal's welfare. Sheep are frequently involved in 4-H projects, and many fairs have sheep classes.

Sheep are also used in sheep-dog trials and shearing contests, which should have welfare supervision similar to that for fairs. Several of these topics are addressed in other fact sheets in this series.

Shearing

Shearing is involved in almost all sheep and Angora goat production, including that in which the primary product is meat. Although some hair breeds of sheep do not require shearing, their productivity is such that they are usually crossed with woolled breeds to achieve a better lamb crop. Shearing is necessary for the well-being of sheep but can negatively affect the welfare of the animal if performed at an inappropriate time. Shearing when animals will be exposed to wet conditions, severe cold, or intense sunshine coupled with high temperatures can result in thermal stress. Failure to shear ewes before confinement for lambing, even in the winter, may result in moisture and health problems in the barn. Shearing itself, however, is a stress on the animal. Corticoid levels increase regardless of the method used, and it is believed the noise, heat, and contact of the clippers induce this reaction ([1,2](#)). The traditional method of up-ending sheep for shearing (resting on rump in upright position) contributes to the stress ([2](#)). Some shearers restrain sheep by

binding their legs, a procedure which is stressful in itself (3) and may result in injuries, but a comparison of the overall stressfulness of this method with up-ending has not been made. Shearing is less stressful if done quickly (4), but cuts resulting from hurried or careless shearing add to stress (2).

Dogs

A flock experiences more stress when approached by a person with a dog than when approached by a person alone. Driving a flock using a dog causes very high, sustained heart rates (5), indicative of fear. Dogs that bite sheep cause much greater stress than nonbiting dogs (4). However, the use of a well-trained dog does not result in high corticoid levels and probably reduces the overall stress of herding by decreasing the time required to complete the work.

Handling

Sheep may be handled several times a year for shearing, drenching, hoof-trimming, and general health inspections. Sheep are restrained during these procedures by hand or in tilt tables. Both methods are stressful (2,6,7), but no comparison of the two has been made. The stress of herding and handling can be reduced by using well-designed and well-maintained facilities (8) and conscientious personnel. Ensuring that the animals maintain visual contact with other sheep is also important to prevent excessive stress (6).

Castration

Several methods are used to castrate ram lambs (9). Surgical castration is less stressful than the use of rubber rings (10), but may represent a greater risk of infection. This risk of infection can be reduced by proper aseptic techniques. Age at castration has little effect on the lambs' response up to at least 42 days of age (10), but it is generally recommended that lambs who are several months old be castrated by burdizzo to prevent other complications. Angora goats may be left intact until they are several months old in order to obtain a muscular frame, and then should be castrated as mature sheep are. The use of a local anesthetic is suggested for surgical castration of mature animals. Many producers would prefer not to castrate their lambs in order to sustain faster and more efficient growth and avoid the stress associated with the procedure. Leaving rams intact is feasible if they are to be marketed before the subsequent breeding season. Packers prefer wethers, however, as their pelts are easier to remove (11); they discount the price of intact animals.

Tail-Docking

Tail-docking is practiced routinely on most sheep operations. Some sheep breeds have short tails that do not require docking. Docking of lambs could be avoided if the lambs' tails and hindquarters could be kept clean of feces and free from flies until marketing. As with castration, failure to perform this procedure may result in lower prices from packers. Because most lambs are exposed to flies, that they must be docked. Docking is stressful (12), but surgical removal appears to be less so than the use of rubber rings (10). There is debate over the length of tail to be left after docking. Many believe a short dock is necessary to show sheep. However, recent research indicates that short docking (1/2 inch) results in more rectal prolapses during the feedlot period than does long docking (3 inches) (13). Unless these results are refuted in further research, breed associations and judges should accept long docking out of humane considerations.

Lambing

Lambing season is often the most intensively managed aspect of sheep production. Efforts to reduce lamb mortality may affect the welfare of individual lambs or ewes. When ewes are lambed in confinement to prevent loss of lambs to cold weather or predation, some lambs may become separated from their dams and abandoned. Proper management of the lambing barn, including provision of semi-isolated lambing sites in the pen, reduces these problems (14). Lambs born on pasture, if the weather is suitable, are less likely to be mis-mothered. An exception occurs when the flock is moved to new pasture or range and lambs become separated from their ewes during the process. This problem can be prevented by moving the flock slowly, allowing lambs to locate their dams before driving begins and keep close to them during the process. Ewes lambed indoors or in small yards are often confined to small pens with their lambs for a

few hours to several days to facilitate maternal care and development of the ewe/lamb bond. Although separation from the flock is normally stressful, the post-lambing period may be an exception. A short separation is actually a normal part of parturient behavior.

Fostering

Fostering lambs is a standard procedure in order to save orphaned lambs or those whose own mothers cannot produce adequate milk. The easiest type of fostering, and probably least stressful to the ewe, is fostering immediately after the recipient ewe gives birth. Since a parturient ewe is not always available when fostering needs to be performed, several other methods are also used. Under such conditions the most common type of fostering involves restraint of the ewe in a neck stanchion for several days ([15,16](#)). Other methods proven successful experimentally, but not as widely known or practiced in the sheep industry, include odor transfer using cloth jackets ([17,18](#)) or association of an odor with the odor of the ewe's own lamb ([19](#)). Of these methods, stanchion fostering involves the greatest degree and length of restraint for the ewe, but no comparison has been made to determine the least stressful system.

Confinement

When intensive confinement of sheep is practiced, wool-picking may occur. Wool picking generally involves one or more sheep picking wool from a less dominant sheep. In some instances, however, a sheep may pick its own wool.

Although the stressfulness of this behavior to the recipient is unknown, it is generally felt that the occurrence of wool-picking reflects a chronic level of stress in the entire pen. Providing sufficient fiber in the diet to stimulate normal levels of rumination is considered the best preventive, but the causes of this behavior are undetermined.

Goats

The welfare concerns for Angora goats are generally very similar to those for sheep. Dairy goats are generally kept in more intensively managed and confined conditions, but appear to adapt well to frequent interactions with humans and to the restraint necessary for milking. Dairy goat kids should be disbudded (horn buds) and males deodorized at a few days of age to minimize the stressfulness of the procedures and to avoid the problems of horned adults ([9](#)). Disbudding may be accomplished by the use of either chemical or hot-iron methods using procedures similar to those used for cattle. Deodorization is accomplished by use of a hot iron. Dehorning of adult goats should be performed by or under the guidance of a veterinarian.

CONCLUSION

A number of the procedures necessary to sheep and goat production are stressful, but benefit the animals overall. Alternative methods of restraint, castration, tail-docking, and fostering are available and should be compared to determine relative stressfulness. Only a few studies of this nature have been conducted, and their results should be used in developing recommendations until additional data are available. The industry should evaluate the practice of short-docking and castration to determine if they can be eliminated or reduced through changes in industry traditions. In general, the sheep industry does not involve the more controversial welfare issues of intensive confinement. In addition, the fact that several alternative methods exist for most standard procedures would indicate that the industry has the potential to readily adapt its practices as research clarifies the welfare implications of various methods.

GLOSSARY

Burdizzo -- A device used in castration and tail-docking to destroy blood flow by crushing tissue.

Deodorization -- A procedure performed on male goats to prevent strong odors in adults. Scent glands near poll of the head are destroyed, usually when the kid is young.

Disbudding -- Destruction of the horn buds in young goat kids to prevent horn growth.

Rubber rings -- A method of castration or tail docking in which a rubber ring restricts circulation to the scrotum or tail, which leads to atrophy and falling off.

Up-ending -- Positioning a sheep so that it is supported on the ground by its rump rather than its legs. Used as a means of restraining animals during procedures such as shearing or hoof-trimming.

Wether -- A castrated male sheep.

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Animal Welfare Issues:

SWINE

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INTRODUCTION

Issues of animal welfare and animal rights are concerns now facing the pork industry. People who raise animals, whether for meat production, companionship, recreation, or other purposes, have a responsibility to sustain the basic welfare of their charges. Modern domesticated and confined animals depend completely upon their caretakers for their nutritional, environmental, and social needs. This is true whether the animals are raised in a pasture system (extensive production) or in an indoor unit without access to soil or grass (intensive production).

DISCUSSION

Assessment of Welfare

Assessment of animal welfare is difficult. The British Farm Animal Welfare Committee, referenced by Muirhead ([1](#)), noted: "There are few positive methods of assessing the well-being and contentment of animals; we must not assume that animals' feelings and reactions are the same as those of human beings. It is clear that a healthy and well-fed animal will not necessarily be a happy, stress-free animal and there are a few positive indicators to evaluate with any accuracy the degree of stress; there is also evidence that some stress is necessary for the animal's well-being." Productivity may not be the best measurement of well-being, but it must be considered as one measure in a battery of measures until more reliable indicators are found. Important measures of welfare include behavior and physiology.

Pork producers have a profound interest in the well-being of their charges. Pig performance and welfare have significant impacts on the success and profitability of the pork production operation. Swine kept in less than ideal conditions have impaired growth rates, reduced efficiency of feed utilization, and low reproductive performance. Stressed pigs show signs of immunosuppression and, therefore, greater disease incidence. They often show behavioral changes, which may differ from one stressful environment to another. Cold-stressed young pigs, for example, show poorer feed efficiency, greater likelihood of respiratory and enteric disease, and they shiver and huddle in a characteristic manner.

Each production practice adopted by producers is intended to optimize economics and to be suitable to the pig's biological needs. Pork producers try to meet or exceed these biological requirements in the most cost-effective manner. Both facility design and management practices make the most of the available alternatives. When some discomfort

must be imposed, the benefit is less overall pain or discomfort. Thus, one animal may have its movement restricted to save the lives of others (as in the farrowing crate where the sow's movement is limited to prevent baby pigs from being crushed).

Extensive pork production cannot by definition be more "pig friendly" or less stressful. Some stressors, such as predators and parasites, affect pigs negatively when encountered during extensive production. Many scientists and pork industry leaders conclude that the stresses of even well-managed extensive pork production

typically exceed the stresses of well-managed intensive production systems. Others have shown overall economic benefits to the use of extensive systems.

Animal welfare concerns about pork industry practices include two areas:

- standard practices that are thought to be painful (e.g., castration), and
- the quantity or quality of space provided to pigs in some housing or penning systems.

Several research laboratories in the United States are initiating projects in swine welfare and behavior. Currently, most projects deal with sow housing during gestation and lactation using newer housing or penning systems. Other projects seek to better understand how pigs perceive their environment through cognitive processes.

Current Production Practices --- Standard Procedures

Several common practices that are considered to cause some pain are regularly performed on newborn pigs by pork producers. Examples include ear notching and tagging, teeth clipping, tail docking, and castration. Pork producers perform these standard practices because they believe each procedure will help the animals and prevent more pain and suffering later in their lives.

Ear notching is typically performed near the time of birth, and the pain is considered to be minimal. If each animal has an individual identification, it can be better treated when it becomes ill, and its progress (in terms of growth and reproduction) can be tracked. Ear tags can also be used (much like piercing ears) to

provide an identification number, but they have the potential disadvantage of falling off. New technology is being developed to implant (under the skin) an electronic identification device that can be read by a computer scanner.

Piglets are born with eight sharp "needle" teeth. Needle teeth are probably used by pigs in the wild to defend against predators. Piglets (domestic or wild), generally use their needle teeth to establish dominance. In so doing, they wound littermate piglets and may tear the sow's udder during suckling. Pork producers use a clean clipper for individual piglets to take the sharp edge off the tip of the needle teeth. The procedure is performed shortly after birth, and the brief discomfort experienced by piglets is much less than might be experienced by sows with shredded udders.

Adult or immature pigs occasionally show an abnormal behavior called tail biting or cannibalism. When a tail biting episode begins, the vice usually spreads quickly in the affected pen and throughout the neighboring pens. The tail has a rich blood supply, and the bleeding tail of the bitten pig stimulates pen mates to further chew the wounded tail. Pigs sometimes bleed to death; in other cases, aggressive penmates chew the tail down to the spinal cord and cause infection, illness, and possibly death. Docking tails soon after birth substantially reduces the incidence of tail biting. Pigs may cannibalize whether they are housed inside or on dirt lots and the practice occurs with widely different stocking densities. An outbreak of tail biting is expected to be very painful for the pigs with bitten tails. The small amount of discomfort caused by docking is much less overall than what would be experienced by pigs during an outbreak of tail biting.

Male pigs usually are castrated within the first 3 to 14 days after birth. New pork industry swine care recommendations (2) suggest that boars be castrated at 2 weeks of age or younger. If males more than 8 weeks old must be castrated, the industry recommends the use of anesthetics to reduce the pain. Most adult male pigs develop a characteristic off-flavor and odor that has been termed "boar odor," which consumers find highly objectionable. Castration substantially eliminates the occurrence of this odor. At market time, pork producers receive much less compensation for boars than

for castrated males (barrows). In a recent demonstration project, boars had only two-thirds the market value of barrows (3).

CURRENT PRODUCTION PRACTICES

Space

Pigs in modern pork production systems are more likely to be found inside buildings than in the more extensive pastoral setting. The move towards indoor systems has probably enhanced pig welfare. Pigs housed inside buildings generally are exposed to a more constant and comfortable temperature, drier, and freer from parasites. Overall animal care is often better when animals are more easily handled. However, well-designed and managed extensive systems promote acceptable animal welfare also.

Much research has been conducted on the subject of crowding. Crowding leads to reduced feed intake, slower weight gain, and increased disease incidence. More basic studies have shown that crowding causes elevated stress hormones and increases aggressive behavior. Therefore, there are both economic and animal welfare reasons for maintaining lower population density.

Space needs for adult sows and boars are less well understood. Adult pigs are typically fed a limited amount of feed, since overfeeding leads to fat animals with lower reproductive success. To maintain normal, lean body weights, sows and boars are fed about one-third of the calories they would eat if given free access to feed.

Adult pigs have very strong social relationships, with one animal having clear dominance over subordinate pigs. Dominant sows that are hungry will steal feed from sows of lower social rank. Sows housed in groups have a greater chance of injuries caused by various aggressive behaviors (e.g., vulva biting (4)). To prevent problems associated with group housing, sows are provided individual feeding stalls or are penned in individual gestation stalls. Individual housing of sows in gestation stalls eliminates the pressures of social stress that group-housed sows experience. Record keeping services (with records on tens of thousands of sows) and controlled studies generally support the idea that penning sows in gestation stalls increases their reproductive performance. Clearly, some genetic strains of swine are more adaptable to indoor housing.

Since stress has dramatic negative effects on reproduction, it is possible that the stress of individual penning is less than the stress of being a submissive sow in a social group. Further study is needed to understand fully the physiology and behavior of sows in individual and group housing systems. An abrupt industry move to certain types of group housing systems for sows could lead to reduced sow welfare.

Alternative Practices

Extensive swine production is an economical component of production in the United States. Land and labor requirements are greater, but this is a viable system for producers with low capital resources. On a per-head basis, extensive systems are as profitable as indoor production, but the net profit of the unit will be less because of smaller volume and less consistent production.

Sows farrowing on pasture in portable houses weaned 0.8 fewer pigs per litter (5) than confined sows and have higher death losses in wet, cold weather. Sows farrowing in pens and turned out to feed and water wean as many or more pigs than sows maintained in a stall for the lactation period. They get more exercise and eat more feed. More time is required to turn sows in and out and to remove soiled bedding.

Research studies must determine which practices are stressful and if those stressors are detrimental. For example, data suggest that individually stalled sows are more productive than group-housed sows, based on productivity and longevity in the herd. Stockmanship also affects stress and performance. Researchers observed a positive relationship between pigs/sow/year and sows that were "at ease" with human caretakers (6). In mild seasons, pigs raised outdoors grow as well as or better than confined pigs. In hot and cold seasons, pigs grow faster indoors.

New housing, penning, and management practices are being developed. Before these new systems are introduced into pork production units, we must be sure they provide animal well-being that is equal to or better than the systems they replace.

GLOSSARY

Barrow -- Male pig castrated before sexual maturity.

Boar -- Intact (not castrated) male pig.

Gilt -- Female pig of any age prior to second pregnancy.

Pig -- Young swine of either sex.

Piglet -- Baby pig.

Sow -- Female swine having produced one or more litters.

Castration -- Removal of testes.

Farrow -- To give birth to a litter of pigs.

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Animal Welfare Issues:

SPECIAL-FED VEAL

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INTRODUCTION

Production of special-fed veal has received widespread public criticism for several reasons: (1) the use of young animals tends to stimulate an emotional response, (2) some people object to some of the system's production techniques (e.g., individual stalls, liquid diets, low hemoglobin levels), (3) the U.S. veal industry is newer and smaller than most other animal industries, and (4) the results of research on the controversial techniques have generally been limited and in some cases contradictory.

DISCUSSION

Veal Classification

USDA ([1995](#)) defines veal as meat from immature bovine animals. This broad definition encompasses four specific types of veal:

- Bob veal -- liveweight of less than 150 pounds.
- Special-fed veal -- fed a special milk replacer diet and marketed at a liveweight of 151 to 400 pounds.
- Non-special-fed veal -- fed a variety of diets and marketed at liveweights of 151 to 400 pounds.
- Calves -- liveweight of more than 400 pounds; fed no special diet.

Bob veal, from young dairy-type calves, is used primarily for processed meat. **Special-fed** veal calves (also referred to as formula-fed, fancy, or nature veal) usually are fed a milk-based liquid replacer diet in which the iron content decreases through the last half of the production cycle. This relatively low dietary iron concentration helps to retain the lighter muscle color that is considered typical for special-fed veal. Special-fed calves are raised in enclosed housing for 18-20 weeks; currently most special-fed veal calves weigh over 400 pounds when marketed. **Non-special-fed** calves are fed a variety of diets, including milk replacer, grain, and forages (hay, silage, or pasture). They may be of different ages at processing, and several cattle breeds and types are utilized. **Calves** are raised in a variety of systems, are of essentially any breed, and are marketed at weights usually over 500 pounds.

Special-fed systems, which are the most frequently criticized, are the primary focus of this fact sheet. Non-special-fed systems are discussed briefly under "alternative systems."

Source and Procurement of Calves

Approximately 800,000 calves enter U.S. special-fed veal systems annually ([AMI 1995](#)). According to USDA ([1995](#)), about 33 percent of male dairy calves are used for bob veal production, about 40 percent for special-fed veal production, and the remainder for other feeding systems, including beef production. In some veal-producing areas, however, up to 95 percent of the male dairy calves are used in veal or beef feeding systems. The numbers of calves used for bob veal, special-fed veal, and "other" calf production declined 71, 22, and 73 percent between 1986 and 1991, respectively ([USDA 1995](#)). However, during the period 1994-97, the use of male dairy calves for beef decreased

because of low beef prices. Since market weights of special-fed veal calves have increased, total veal production (in pounds) has remained fairly constant.

Dairy producers generally have little use for newborn male calves. Calves usually are separated from dairy cows at 1 to 4 days of age to allow the dairy producer to harvest milk; this separation is subject to criticism ([e.g., Harrison 1972](#)). However, the maternal-filial bond becomes more established as the cow and calf remain together; thus the stress of cow-calf separation becomes greater. Veal producers typically obtain calves through livestock auctions, although in some cases the calves are taken directly from the dairy farm to the veal farm.

Immunocompetence of calves that are intended for veal production is a concern of the dairy and veal industries for both economic and animal welfare reasons. Calves have low levels of circulating immunoglobulins at birth. Consumption of colostrum (first milk after calving) by the calf within 12 hours after calving provides passive immunity and reduces subsequent mortality ([White and Andrews 1986](#); [Aldridge et al. 1992](#)). The percent of calves receiving adequate amounts of high-quality colostrum and thereby developing satisfactory passive immunity may vary regionally. In a study in the Western United States, Stull and McMartin ([1992](#)) reported that approximately 20 percent of calves entering veal systems had received adequate levels of colostrum. In a Pennsylvania study, however, Wilson et al. ([1994](#)) concluded that between 60 and 80 percent of calves entering veal production systems had received sufficient colostrum. Adequate immunity enhances the health and well-being of the calf throughout the feeding cycle, thereby necessitating less use of animal health products and increasing financial stability for veal farmers.

Handling of the calves from the dairy farm to the auction market and/or the veal or dairy-beef farm has been addressed ([Grandin 1989](#)). Guidelines have been developed to minimize stress during marketing, transportation, and processing ([Grandin 1988](#), [1991a](#)); there is unpublished evidence that these guidelines are being used by industry.

Individual Stalls and Tethers

Most U.S. veal farms use individual stalls or pens. Both Canadian and U.S. guidelines ([Agriculture Canada 1988](#); [Curtis et al. 1988](#)) recommend stalls at least 24 inches wide and 65 inches long. Most veal barns being constructed or renovated have stalls that meet the current industry recommendations of 26 to 30 inches wide and 72 inches long ([AVA 1993](#)). Floors are constructed of either wood slats or plastic over metal; fronts (through which calves may put their heads) and sides are made of wood slats. The stall partitions between calves are usually 24 inches long. The stall is open at the back and top; calves are tethered to the front of the stall with 2 to 3 feet of plastic or metal tethers.

The use of individual stalls and the tethering of calves have been criticized because these practices limit social interaction among calves, prevent total body grooming, and restrict movement ([Harrison 1972](#); [Robbins 1987](#)). The calf can stand or lie in a natural, sternal position and take several steps either forward or backward ([Albright et al. 1991](#); [Stull and McMartin 1992](#)). Calves can reach and groom most parts of their bodies. Proponents of individual stall systems contend it allows more effective regulation of air temperature and humidity through heating and ventilation, effective managing and handling of waste materials, limited transmittal of pathogens between calves, individual observation and feeding, and, if necessary, examination and medical treatment with less stress from handling. The design of the contemporary veal production system, e.g., ventilation, is being further researched ([van 't Ooster 1991](#); [Hillman et al. 1992](#); [Wheeler et al. 1996](#)).

Individual stalls are arranged in rows, allowing calves to have visual and head-to-head contact with their immediate neighbors. This limited interaction is beneficial in minimizing disease transmission and preventing some abnormal behaviors. Conflicting and inconclusive results have been reported with regard to the effects of housing system on stress indicators (white blood cell ratios, blood cortisol concentrations, abnormal or stereotypic behavior) in group and individual housing systems ([Dantzer et al. 1983](#); [Knesel et al. 1983](#); [Winters et al. 1984](#); [Dellemeier et al. 1985](#); [Friend et al. 1985](#); [Reece and Hotchkiss 1987](#); [Stull and McMartin 1992](#); [Terosky et al. 1996](#)). Several behaviors of group-reared veal calves can be detrimental to their health, including sucking of pen-mates' ears, navels, and genital sheaths, which often produces inflammation and infection. Urine drinking, which can affect digestion and health, has been documented in group-reared calves ([Stephens 1982](#)).

In a study comparing individual stalls with pens containing up to 50 calves, more health-related problems were observed

in the group-rearing situations ([Steenkamer 1982](#)). A significantly higher morbidity was experienced in calves housed in group pens, with enteric and respiratory diseases as the most common causes ([Webster 1991](#)). Individual stalls resulted in lower incidence of salmonellosis than group housing ([Linton et al. 1974](#)). Treatment of sick calves was more difficult in group-reared situations due to problems in tracing and examining sick calves, administering medical treatment, and evaluating individual dietary intake. Another study also observed higher mortality in group-reared calves (9.4 percent) than in individually stalled calves (2.2 percent) ([de Wilt 1985](#)).

It was once thought that veal calves should be raised in darkness to produce a pale-colored meat. In a recent study of 10 commercial veal facilities, all barns were equipped with adequate supplemental lighting; 6 of the 10 facilities had natural light sources through windows or doors, and none of the facilities incorporated darkness as a deliberate component of the production system ([Stull and McMartin 1992](#)). The American Veal Association ([AVA 1993](#)) recommends that adequate levels of light be available for inspection, feeding, and monitoring.

Nutrition

Special-fed veal calves are fed liquid low-fiber diets throughout the 18- to 20-week production cycle. The milk replacer diet is composed of surplus dairy products including skim milk, whey, and sweet buttermilk cream added to water. Plant- and animal-derived fats, proteins, and other supplements such as minerals and vitamins are also included. The milk replacer diet fed to veal calves contains known essential nutrients to ensure normal growth and health. It is a recommended practice to provide water to the calves between the twice-daily feedings of milk ([AVA 1996](#)). Special-fed veal calves gained 2.0 to 3.5 pounds per day on milk replacer diets ([Stull and McMartin 1992](#); [Wilson et al. 1994](#)). This compares to an average daily gain of 1.5 pounds per day for dairy replacement heifers consuming both liquid milk replacer and forages on a limited basis ([Schmidt and VanVleck 1974](#)). Beef-breed calves suckling their dams and consuming pasture averaged 1.8 to 2.5 pounds of weight gain per day (e.g., [Ansotegui et al. 1991](#)).

The amount of iron in the diet of special-fed veal calves is carefully controlled to produce the pale-colored meat product preferred by marketers and consumers. The priority of dietary iron usage is for blood hemoglobin rather than for muscle myoglobin. Veal producers routinely evaluate blood hematocrit or hemoglobin levels throughout the production cycle and use the results in determining dietary levels of iron. Dietary iron is regulated to maintain blood hemoglobin levels between 7.5 and 8.5 grams per decaliter (g/dl). However, Webster ([1989](#)) claims that it is impossible to ensure "white" veal without creating clinical anemia in some calves. Anemic calves exhibit a loss of appetite ([Bremner et al. 1976](#); [Roy 1980](#)), which is detrimental to calf growth rate and feed efficiency, and therefore uneconomical. Thus, growers usually limit iron only during the last stages of production in an effort to decrease the myoglobin content of the muscle but not induce harmful circulatory anemia.

McFarlane et al. ([1988](#)) studied the physiological and behavioral characteristics of calves raised on various dietary regimens comparable to actual industry practices. They concluded that dietary iron levels did influence some blood variables, but not the health or behavior traits of the calves; no calf from any of the treatments had impaired muscle coordination. In trials with commercial veal producers, hemoglobin averages of 9.0, 8.0, and 7.8 g/dl were obtained by Stull and McDonough ([1994](#)), Egan et al. ([1993](#)), and Wilson et al. ([1994](#)), respectively. Agriculture Canada ([1988](#)) concluded that blood hemoglobin levels of 6.5 g/dl or less are unacceptable since the well-being of the calf is not ensured.

Most of the available data suggest that veal calf health is not enhanced by the inclusion of forage or grain in the diet ([Agriculture Canada 1988](#)). Welchman et al. ([1988](#)) added straw to diets of milk-fed veal calves kept in either stalls or loose housing. The results confirmed earlier studies; the addition of straw did not prevent iron-deficiency anemia, but it did improve behavior of the calves. However, straw has also increased the incidence of abomasal ulcers in veal calves ([Van Putten 1982](#); [Welchman and Baust 1987](#)).

Carcass Characteristics and Marketing

Proponents of special-fed veal production and marketing (e.g., [Follenweider 1991](#); [Metz 1991](#)) maintained that carcasses with light muscle color are essential in assuring the predictability of veal product quality. Carcasses with more muscle pigmentation may have resulted from a wide variety of different cattle types, ages, and diets, thereby

causing more variability in product quality. The pale color of meat products is the major indicator to the consumer of special-fed veal. Within any group of veal calves, from 2 to 10 percent may be priced lower because of darker colored muscle. The price differential between the highest two grades is 20 percent or more. Requirements of the marketing system, market prices, and other economic constraints may not be considered a high priority when evaluating the well-being of animals within a production system. If the industry is financially stable, however, producers should be better able to make improvements in various production components that enhance the well-being of the animals.

Handling of animals at the processing plant has also been criticized. Handling methods that reduce animal excitement, anxiety, and suffering during this final production step have been developed ([Grandin 1991b](#)) and applied by industry.

Animal Health and Product Wholesomeness

The predominant diseases in veal calves, as in most other young animals in either intensive or extensive systems, are enteric (e.g., diarrhea) and respiratory (e.g., pneumonia) ([Fallon and Harts 1983](#); [Peters 1986](#); [Roy and Smith 1987](#); [McDonough and Stull 1994](#)). Average mortality rates in veal calves ranged from 2.9 to 4.4 percent in recent research reports ([Webster 1991](#); [Stull and McMartin 1992](#); [Wilson et al. 1994](#)). This percentage is similar to or lower than that of other calf production systems. For dairy heifers raised on farms as herd replacements, mortality from birth to 3 months averaged 6.5 percent in Virginia ([James et al. 1983](#)) and 3.7 percent from birth to 1 year of age in Pennsylvania ([Heinrichs et al. 1987](#)).

Stull and McMartin ([1992](#)) monitored two production cycles in each of 10 different commercial veal farms and documented the amount of animal health products used during different phases of the feeding cycle. They concluded that the use of individual treatments after the first 28 days declined to less than 5 percent of calves at the conclusion of the 16-week production cycle. Current recommended codes of practice for the care and handling of special-fed veal calves (Agriculture Canada 1988; AVA 1996) maintained that medical treatments and vaccinations must be based upon veterinary advice, with particular attention given to adhering to safe withdrawal times before slaughter. Perhaps the most credible source of information with regard to the wholesomeness of the special-fed veal supply is the USDA's Food Safety and Inspection Service. In the 1994 monitoring program conducted by FSIS, 0.075 percent of randomly sampled carcasses had violative levels of chemical residues ([FSIS, USDA 1996](#)). The percentages of violations in both the monitoring and surveillance programs have decreased markedly since 1989 when the violative residue frequency was 0.89 percent and a comprehensive quality assurance program was initiated.

ALTERNATIVE SYSTEMS

Research examining alternatives to special-fed veal production systems has focused on the inclusion of solid feed to the liquid milk-based diet, group rearing of older calves, and use of pasture. Most of the information concerning alternative systems that use pasture and/or grain supplements has been obtained from research trials (e.g., [Buege 1989](#); [Wilson et al. 1991](#)) or from pilot veal production units (e.g., [Brown 1991](#)). These systems are not currently widely practiced. The carcass produced under this system is similar to the USDA non-special-fed veal (calf) classification with more muscle pigmentation than in special-fed veal carcasses.

Critics of the U.S. veal industry refer to the changes in veal production methods in England, as well as those contemplated in Holland (a major veal-producing country). Stalls are not used for veal production in England, and group-rearing is the only accepted method. Since the cessation of the use of individual stalls, veal production in England has declined abruptly. Individual stalls are still used in Holland throughout the 24- to 26-week veal production cycle. Pending legislation in Holland may allow use of individual stalls only during the first 8 weeks of the production cycle, with group rearing in small groups from 8 weeks to market. In evaluating changes that have occurred in Great Britain and European countries, it must be remembered that some of these policies have been brought about by political, trade, or societal issues, and not necessarily by science-based studies. The U.S. veal industry continues to encourage research that will enhance animal well-being, food safety, and consumer confidence, while recognizing societal concerns about production methods.

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Attitudes to Animals: An Overview of Animal-Related Organizations

A Preliminary Classification

	ANIMAL EXPLOITATION		ANIMAL USE		ANIMAL WELFARE		ANIMAL RIGHTS		ANIMAL LIBERATION		
1.	<i>Humans have absolute dominion over animals. They can be used or abused for any purpose without restriction, for sports, profit, etc.</i>	1.	<i>Animals can be used to meet human needs for food, biomedical research, entertainment, weapons deployment, labor, and clothes etc. Believe they can police themselves and don't need laws.</i>	1.	<i>Individuals and groups expressing a responsibility to protect animals from harm. Limits should be set on animal use for human purposes and, in order to achieve socially acceptable standards, these activities may need to be regulated by law.</i>	1.	<i>Animals have intrinsic rights that should be guaranteed just as ours are. These rights include not being eaten, used for sport or research, abused, or killed.</i>	1.	<i>Animals should not be put to work or to produce for our benefit in any way. We should try to eliminate all types of animal use as well as abuse. Some will not keep pets considering it a form of enslavement.</i>		
2.	Groups advocating or conduction activities involving animals which are illegal (for the most part) in this country. Most of these activities were not prohibited in the past and may not now be so in other countries.	2a.	Groups promoting or representing: animal experimentation, hunting trapping and fur industry, meat and poultry industry, rodeos, exotic animal keeping. Includes commercial suppliers of laboratory animals, commercial pet breeders, furriers, and livestock producers.	2a.	National and local animal welfare organizations and shelters, wildlife conservation and environmental protection groups. A primary activity is to education the public about their responsibilities to animals. Some local groups undertake the control of overpopulation of pet dogs and cats.	2a.	National and local animal rights groups, and anti-vivisection societies.	2.	Groups openly calling for animal liberation. Some feel that this can be accomplished only by a complete restructuring of society's economic base and property rights.		Clandestine or underground groups whose tactics include illegal actions such as harassment, destruction of property, removal of experimental or other animals considered to be suffering or likely to be destroyed, and violence.
		2b.	Veterinary groups								
3	Bull fighting Dog fighting Cock fighting (legal in some states) Live pigeon target shooting Poaching and trading in exotic and endangered species	2c.	These groups usually have guidelines by which their activities are conducted; some are regulated by law. The pro-animal research groups resist any limits being placed: they favor use of pound dogs and cats for experimentation and can be opposed to alternatives of reduction, replacement, and refinement.	3.	The broad agenda for these groups is to set limits on activities. Thus pets should be kept only be responsible persons; animals can be used for food but not "factory farmed"; animals can be used as subjects of selected animal experiments but not any and all experiments; oppose use of pound animals for research; support use of alternatives and seek to reduce use of primates. These groups oppose blood sports and favor protection of wildlife.	3a.	Speak out against use of animals for experimentation, hunting, factory farming, rodeos, circuses, and exhibition of wild animals in zoos, etc. Urge public demonstrations, peaceful confrontation, and civil disobedience.				
		3.	Laboratory experiments for research, testing, and education, hunting, meat eating, rodeos, trapping and breeding animals for fur, etc.			3b.	Divided between those working for the regulation of activities such as research, rodeos, etc. and abolitionists calling for their total ban. The abolitionists may blame or even attack animal welfare groups for "compromising."				
						3c.	Depending on their sensitivities and priorities, members do not hunt, or patronize				

							entertainments or sports involving animals, and are willing to forgo the results of medical research or production involving animals e.g. vaccines, luxury furs, meat, egg and milk products, and leather.		
4.	The method of killing, however painful or protracted, is of no concern.	4.	Ideally, killing should be fast and painless but this is not always possible.	4.	Killing, when needed, must always be fast and painless.	4.	Oppose the killing of animals except to reduce suffering.	4.	Avoid killing animals.
5.	Willing to break laws.	5.	Unlikely to want present laws increased or strengthened. Usually fight any proposed new regulation.	5.	Insist on enforcement of animal protection laws. favor increased oversight and public scrutiny of the use of animals in may contexts.	5.	Some restrict their activities to public demonstrations, legal challenges, and civil disobedience. Others are self-styled anti-cruelty investigators who "rescue" animals without benefit of due process.	5.	The cause is so noble that it justifies breaking the law.

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